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DECORATION

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Apparatus used for the Experiments on Trap-Siphonage.

THE CELEBRATED

SANITAS

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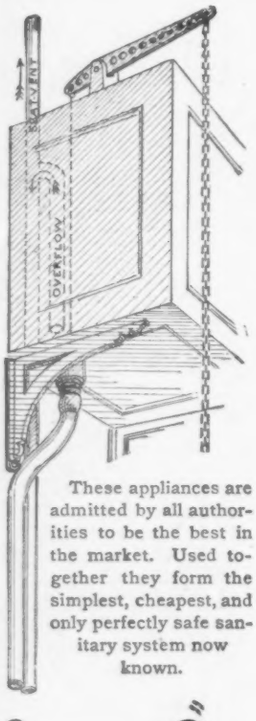
APPLIANCES.



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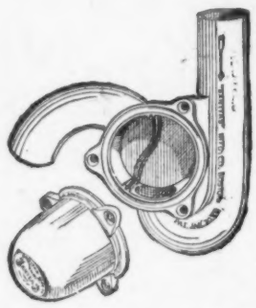

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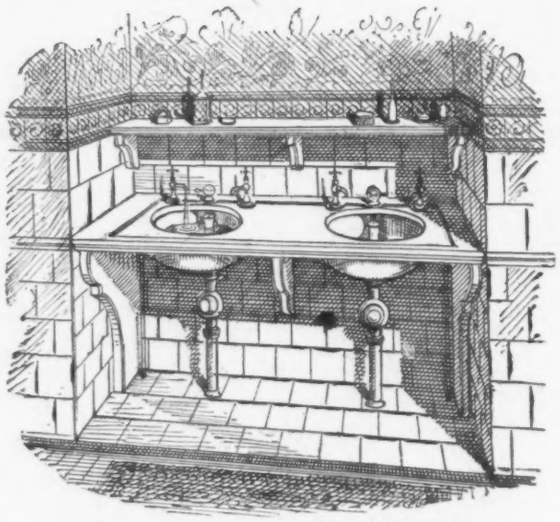

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A GOOD deal of discussion is going on, particularly in the Western States, in regard to the establishment of a system of licensing architects, in the same way that physicians are already licensed in many States, and it seems likely that two or three experiments of the kind, at least, will be tried before another year. The plan proposed is to establish a Board of Examiners, who will examine all candidates for the practice of the profession, and, if they find them possessed of the requisite knowledge and skill, will recommend them for a license. There can be no doubt that in the case of the medical profession the system of requiring evidence of skill in the shape of a diploma of recognized value, as a condition of exercising that profession, has worked well, and the official records of the States in which the system has been adopted contain many amusing accounts of the struggles of the authorities with the ignorant and heartless charlatans whom they finally succeed in dislodging; but there is some doubt whether the application of a similar rule to those who wish to be architects would be so easy. There is no question that it is as desirable to make sure that architects understand their business as that doctors comprehend theirs; but while the attainments of physicians are inquired into and attested by bodies of examiners at the medical schools, whose interest as well as duty it is to make their examination thorough, and keep their standard high, those who wish to become architects can in this country rarely show the diploma of a recognized school of architecture, and must depend, for the attestation of their qualifications on the verdict of a board of strangers sitting at rare intervals, serving usually without pay, and obliged to hurry through their work. In the majority of cases the decision of the Board would undoubtedly be correct, but there would sometimes be cases where unfit persons would present themselves for examination, and a license once granted could not easily be revoked. We think that the examiners in most medical schools would say that their acquaintance with the candidates, particularly in the case of men whose rank on the examination list is rather doubtful, often proves to be of great value, and the personal element in such tests cannot well be dispensed with. In the case of architects it might perhaps be secured, with advantage to all parties, by committing the examination, or at least some portion of it, to local professional associations. If we are not mistaken, the Boston Society of Architects, one of the largest in the country, already requires that candidates for membership shall pass a satisfactory examination before a committee appointed for the purpose; and although it would, perhaps, be premature to expect that private associations should be empowered to represent the public in granting licenses, their certificate of admission might be accepted at least for a part of the required evidence of qualification, and it would be as easy for them to examine a dozen applicants a month as one. To the local associations of architects, some such public recognition of their authority would be of considerable service, and in return, the assumption by them of the duties of holding at least the preliminary examinations for license would not only relieve the public, but would have the advantage of providing candidates about whose general character something was known. At present, of course, no one can be elected to a professional society without the recommendation of a committee of some sort, whose duty it is to inquire into his antecedents, and if the local societies were to take charge of public examinations while they could not exclude candidates, they would be sure to know something about nearly all of them, and might at least, as do the masters of preparatory schools, add some sort of personal observations to the statement of the results of the examinations.

SOME weeks ago a demonstration of trades-union principles took place in New York, which excited unnecessary astonishment among the newspaper editors and other persons in that city who enjoy the untrammelled use of their faculties. Mr. Lewis H. Williams, a very well-known builder, and a man of the highest integrity and ability, made up his mind long ago that he could manage his own business better than any one else could manage it for him, and has for years carried out the succession of important contracts with which he was entrusted in such ways as seemed to him best. One of his ways was to try to interest his men in their work, and to inspire them, as well as other persons who knew him, with confidence and regard, and we can testify from personal knowledge that he succeeded. In the course of his business he became satisfied that he could reduce the number of working hours of his men, without much detriment to his own interest, and with advantage to them, and more than two years ago he voluntarily made his week's work consist of fifty-seven hours, instead of the customary sixty. Six months later, in the hot, but busy months of June, July and August, he reduced the number to fifty-three hours, by stopping work at noon on Saturdays, and about a year ago he made another change, by which the fifty-three hour standard, with the Saturday half-holiday, were made the uniform rule throughout the year. All this was done, it is needless to say, without consulting the union officials, and he selected his men in the same way, employing those whom he considered honest and faithful, without regard to their society affiliations, and paying them according to their skill, his scale of wages varying from three dollars and a quarter to five dollars a day, the rates remaining unchanged throughout the successive reductions of working time.

LAST November, Mr. Williams, out of the kindness of his heart — for he could have had no selfish interest in making so large a sacrifice — issued a circular to his men, offering not only to continue their wages as before, but, in addition, to divide among them regularly one-half the profits of his business, in proportion to the wages which each one earned. As his business is a large one, keeping about one hundred and fifty men employed, and is managed with great prudence and success, this offer was naturally a tempting one, and was immediately accepted by the men. Meanwhile, however, the professional friends of the workingman had heard that Mr. Williams's employés were becoming so contented with their lot as to be in danger of forgetting their allegiance to the "walking delegates," but when they learned that they were actually on the point of sharing in the profits of the business, their alarm lest they should not only "accumulate some wealth," but also some foresight and energy, became so intense that they resolved to interfere at once, before the men should get too far away from the condition of mind which they consider suitable for working persons; and Mr. Williams was served with a "demand" that he should immediately discharge all his non-union men, and should level off the wages of the others to a uniform average of three dollars and a half a day. Mr. Williams submitted this summons to his men, who voted unanimously that they preferred his terms to those ordered by the union, and that they would keep to their agreement. Even the men who were paid, exclusive of their share in the profits, but three dollars and a quarter a day, instead of the rate required by the union, joined with the others, frankly acknowledging that their work was worth no more, and that they would much rather take that than go without employment, as would otherwise

probably be the case; while those who received four and five dollars a day, with a dividend at the end of the year in addition, naturally viewed the union's proposal to reduce their wages with very little favor. The union leaders, finding their commands disregarded, began to make a display of that terrible power which they use so cruelly, and ordered a general strike on all the buildings in which Mr. Williams's men were engaged, sending, at the same time, delegates to threaten the individual workmen who belonged to the unions. Three of these were so far frightened that they left their work, but two of them came back a day or two later, and the struggle between the overwhelming force of organized and drilled industrial slavery on one side, and new-born independence and hope on the other, has gone on ever since, with the result still undecided. The temper of Mr. Williams's men, and the intelligence with which they uphold their cause, may be judged from a remark of one of them to a reporter of the New York *Times*, which is well worth remembering. Speaking of the system of profit-sharing, this man observed that it was "of peculiar benefit" to the men of inferior skill, for the reason that it interested his companion in teaching and helping him, so as to enable him to do his part of the work with a rapidity and knowledge proportionate to theirs. "Under the union's system," said he, "if one of these men gets stuck on a piece of work which he does not understand, and asks a fellow-workman for advice, he will not get it. On the other hand, with us there is a common interest which makes us help each other, and if a fellow needs a little help he gets it readily, because we all want the job done as quick as possible, so that the division of profits may be more satisfactory." There is material for a volume of social science in these few words, as well as for a good many sermons.

THE *Deutsche Bauzeitung* gives a brief but interesting account of the journey to Japan of Herr Wilhelm Böckmann, the distinguished architect of Berlin. It will be remembered that a year ago a commission of high Japanese officials was sent to Europe to inspect the principal public buildings, and to get such information in regard to the more eminent architects and their work as would enable the Government to select an architect to design and carry out a series of great building works which it has now in contemplation. The Commissioners did their work well, and made an excellent choice in nominating Messrs. Ende and Böckmann of Berlin, whose names are connected with much of the best and most beautiful building in Germany. As soon as the preliminaries had been settled, Herr Böckmann started for Japan, to look over the ground, study on the spot the conditions of the problem, and consider the methods of obtaining proper material for works of a sort as yet little known in Japan. He took with him one of his assistants, Herr Mänz, intending to leave him in general charge of the work on the ground. The two gentlemen left Berlin early in the spring for Brindisi, where they took a steamer for India by the way of the Suez Canal and the Red Sea, and from India sailed to Japan, reaching Tokio on the thirtieth of April.

HERE they were received with much distinction, and were assigned quarters in the house which the Japanese Government has built for the reception of its guests. Their first business was to examine the ground set apart for the proposed group of public buildings, and Herr Böckmann had the courage at once to pronounce it unsuitable. His opinion was listened to with respect, and he was requested to make plans for providing a more suitable site; and, although his new plan, which necessarily looked to the effective and dignified grouping of a number of very large buildings in the best position in a city of a million inhabitants, involved a considerable amount of demolition and rearrangement of streets, it was adopted. A month was spent in overcoming this unlooked-for difficulty, before Herr Böckmann's intended work could begin; but he proceeded at once with his preliminary sketches for the first buildings to be erected, consisting of the Parliament House, the Imperial Court-House and Ministry of Justice, and the Prefecture of Police. By what must have been extraordinary industry, combined with great capacity and experience in mastering such complicated problems, he completed his sketches for all these buildings, and obtained their approval from the Government, in about a month more, and still had time to examine stone-deposits and clay-beds enough to decide upon the site of brick-yards, and of certain quarries, before the second of July, when he left Tokio for home by way of San Francisco and New York, arriving in Berlin on the fourteenth of August, after making in five months a journey around the world, including a stay of two months at the antipodes. From the sketches brought back to Berlin the working drawings are to be made, and in the spring of this year, Herr Ende, the other partner in the firm, will take them to Japan, and direct the laying of the foundations. The construction of the two most important buildings, which will occupy about five years, is to be carried on under the responsible supervision of Messrs. Ende and Böckmann, but the Prefecture of Police is to be built under the care of Herr Mänz, and of Mr. Josiah Conder, a clever English architect who has for several years held an official position in Japan; Messrs. Ende and Böckmann giving the work only general direction. For the better control of the workmen employed on the buildings, arrangements have been made to send immediately to Berlin two young Japanese architects, who will be taken into Messrs. Ende and Böckmann's office, and twelve young mechanics, who are to be distributed among the best houses engaged in their special trades. These men, by the time their services are required, will be tolerably familiar with European methods of work, and will be also of great use as interpreters.

A VIGOROUS effort seems about to be made to convert Paris into a seaport, by means of a ship-canal extending from Rouen, the present head of navigation on the Seine, to Saint-Denis, the manufacturing suburb of Paris. It will be remembered that Paris is already, with perhaps the exception of Buffalo or Chicago, the most important centre of inland navigation in the world, and the Parisians, who see constantly before them the spectacle of London, with its forests of ships, forty miles from the sea, have for many years desired to find means for uniting a waterway to the sea, comparable with that which London enjoys, with the network of inland canals which it alone possesses. It is likely to be a long time before an artificial Thames extends from Paris to the Channel, but in the meanwhile a good canal will be much better than nothing, and this can, if the French Government grants the concession desired, be built at once, at the expense of a private company, which has adopted the plan prepared by M. Bouquet de la Grye, and is ready to construct the canal without cost to the public treasury, asking in return only the right, for ninety-nine years, to collect a toll, not exceeding three francs per ton, on all vessels passing through the canal, to or from Paris, together with the privilege of cultivating or renting the portions of the bed of the river laid dry by its construction. The canal which the company proposes to build will follow in general the bed of the river from Saint-Denis to Rouen, but the channel will be straightened and regulated by artificial banks, and two of the long bends of the river, at Pont de l'Arche and Sartrouville, will be cut off by a straight ditch across the chord of the arc formed by the present channel. There will be three locks, and perhaps a fourth, but the canal will be so wide and deep that vessels can pass through it quickly, and the time occupied in the passage from the sea to Paris will not usually exceed twenty-four hours. The proposed depth is six metres, or about nineteen and one-half feet, which will be sufficient for vessels of two thousand or twenty-five hundred tons, and the width will be one hundred and fourteen feet in the straight parts, and one hundred and forty-six feet at the curves, so that ships can meet and pass at any point. Although twenty-six existing highway bridges will have to be altered over into drawbridges, it is remarkable that no important railway is intercepted by the canal, and, by changing slightly the course of the present line from Paris to Havre, it will be possible to avoid interrupting any important railway route. According to the Commandant Cugnin, who writes an interesting description of the scheme to *La Semaine des Constructeurs*, the cost of constructing the canal will be about twenty-two million dollars, and it can be finished in three years. With the rate of tolls proposed, the cost of carrying merchandise to Paris in the same vessels that have already brought it to Rouen will not exceed ninety-six cents per ton, while the cost of transhipping it to lighters at Rouen, and conveying to Paris, under the present system, is about a dollar and eighty-three cents per ton. By means of this great saving it is hoped that Paris, as a point of embarkation for goods exported from Switzerland and eastern France will be able to compete with Antwerp, which is rapidly securing a large part of the maritime business of the Continent.

TRAP SIPHONAGE.[1]

ENGLISH CHAIR.
FROM THE MONITEUR DES ARCHITECTES.

THE experiments on trap siphonage made by S. S. Hellyer, of London, and similar experiments conducted by Philbrick and Bowditch, of Boston, clearly proved the utility of trap ventilation. The experiments of George E. Waring, of Newport, and J. Pickering Putnam, of Boston, as clearly (apparently) proved the uselessness of such ventilation. In the preparation of a work on plumbing, I found this conflict of authorities very perplexing. In fact, it was impossible for any one to form a definite conclusion on the efficiency or inefficiency of trap ventilation without actual experiment. The difficulty and the object to be attained were laid before Dr. J. Mills Browne, medical director, United States Navy, in charge of the Museum of Hygiene at that time. Upon consulting with the surgeon-general of the navy the subject was thought of sufficient importance to have a system of iron and lead pipes with fixtures erected outside of the museum building. With these pipes I have been conducting experiments from the fall of 1885 to the present time, as opportunity would permit. The waste and vent pipes are of the sizes used and arranged as in common practice. The traps on which the tests were made were selected so as to cover the different kinds in the market, both mechanical and non-mechanical. The apparatus is so arranged that the fixtures can be subjected to a strain equal to what they would receive in actual use, as well as strains more severe than they would have to withstand, except in unusual contingencies.

The points or places of inspection, and for the attachment of traps, are platforms located on the first, second, third and fourth stories, as shown in the drawings attached hereto. By this arrangement the effect of water discharged from varying heights can be thoroughly tested in their relations to the different stories of a building. There is a marked change in the effect produced in different stories of a building by a discharge of water from the same point.

The main stack of pipe is of four-inch extra heavy cast-iron, starting at a connection with the sewer (branches, valves, and connections being inserted at the proper points) and running thence a distance of thirty-two feet horizontally, and forty-two vertically, to a point above the roof of the building. In the second story there is an auxiliary stack of four-inch lead pipe connected with the iron pipe and running to a point above the roof. Both the iron and lead pipes have running-traps and fresh-air inlets near their points of commencement, with valves and screw-plugs, by which they can be partially or completely closed as desired. By means of a Y-branch the system can be made to empty into the sewer without passing through the running-trap. Either outlet can be used at pleasure, both being governed by gate-valves. Two stacks of three-inch vent-pipe (one lead, the other iron) run vertically from the second story to the roof, thence horizontally along the roof. By means of plugs and valves the lengths of the vents may be varied from a few feet to forty-two feet, and the opening from nothing to three inches. The outlets in both the soil and vent pipes are so arranged that traps from one and one-fourth to four inches, can be attached at pleasure, all outlets not in use being cut off by gate-valves or screw-plugs.

Siphonage, caused by the discharge of water through the trap itself from a fixture above, has been found of very little consequence: siphonage rarely takes place, the water passing over the long arm of the siphon rarely fills the pipe so as to cause the necessary vacuum. When it does take place, the trap fills by the drainage from the fixtures above, such as the wash-basin or sink. The back-pressure which comes from sewers would never force the seal of a trap in a house plumbed according to modern practice, the fresh air-inlet and the top of the soil-pipe being always left open. The greatest danger arises from the discharge of large bodies of water down the long vertical four-inch pipes. This column acts to a certain extent like a piston, compressing the air in front of it and creating a vacuum behind it. The air rushing in to fill the vacuum forces or draws the water from the traps into the soil-pipe, while the compressed air finds its easiest mode of escape through the traps below the point of discharge, even when there is a fresh-air opening between the running-trap and the house. Although the water, in case of back-pressure, is driven up into the pipe or fixture above the trap and then returns to the trap, *the sewer air passes into the house.* The majority of the experiments have been made to test the power of traps to resist the siphonage and back-pressure produced by the column of water passing down the vertical pipes. The question of first importance is: *Does ventilation protect the seal of traps in ordinary use?* This question is answered by the following experiments, in all of which the vent-pipes were open, and a positive effort was made to break the seal of the trap. In the first experiment the fresh-air inlet at the foot of the soil-pipe and the opening at the roof were closed, in this way subjecting the traps to the greatest strain which they could possibly have to resist for either siphonage or back-pressure:

EXPERIMENTS.

Number 1. A 3-inch lead trap was attached to the outlet in the second story and the water discharged from the tank in the fourth story through a 4-inch opening; the column of water passing down the vertical pipe a distance of 30 feet before it reaches the branch to which the trap is attached; the air confined in the 4-inch pipe between the running-trap and water-column was forced out with considerable violence through the vent-pipe; the outlet of vent in trap was 2 inches in diameter and ran into a 3-inch vent-pipe, which extended up above the fourth story; a discharge of 15.5 gallons created a slight commotion in the trap, from a sixteenth to an eighth of an inch, splashing out when the trap was full.

Number 2. The same discharge, same condition (except the small amount of water shaken out of the trap), no effect.

Number 3. Same as Number 2.

Number 4. A 1½-inch trap was connected at the same point, the 3-inch lead pipe being removed: inch vent-pipe open, 15.5 gallons discharged from the tank; water only shaken a little; none thrown out.

Number 5. Same conditions; 7.75 gallons discharged through 4-inch opening in tank; no effect on the seal of trap.

Number 6. A discharge of 15.5 gallons through 2-inch opening in tank; no effect on the seal of trap.

Number 7. Same as Number 6.

Number 8. Same as Numbers 6 and 7.

The fresh-air inlet was now opened and the following experiments tried:

Number 9, Sanitas trap attached; 7.75 gallons discharged through 4-inch opening; no effect on seal.

Number 10. Same as Number 9.

Number 11. Same as Numbers 9 and 10.

An opening was now left near the top of the soil-pipe, a practical illustration of an open fresh-air inlet and top of soil-pipe, and the following experiments tried:

Number 12. A 1½-inch lead trap was attached at the same point; 15.5 gallons discharged through the two-inch opening of the tank; no effect on the seal of trap.

Number 13. Same as Number 12.

Number 15. Fred Adee's 1½-inch trap was connected at the same branch of the soil-pipe. 1-inch discharge of 15.5 gallons through the 2-inch opening of the tank. No effect on the water-seal of the trap.

Number 16. Same condition; same effect.

The point of experiment was now transferred to the third story and the traps attached at that point, the discharge being made from the same tank on the fourth story.

Number 17. A 1½-inch Bennor's trap was connected with the branch from the main soil-pipe; discharge of 15.5 gallons through the 4-inch opening in the tank. No effect on the seal of the trap.

Number 18. A small 1½-inch S-trap was inserted; the same discharge and the same effect.

Number 19. A 4-inch S-trap was connected. Same discharge; same effect.

The following experiments were made with vents more or less closed:

Number 20. A 4-inch S-trap. The outlet to vent was half closed. There was considerable commotion in the trap, but the seal was not in any way affected by 7.75 gallons discharged from the tank through the 4-inch opening.

Number 21. Same experiment; same effect.

Number 22. The outlet of vent was three-quarters closed, and a discharge of 15.5 gallons was let out of the tank. There was a great commotion in the trap, the water being lowered until only a quarter of an inch seal remained.

Number 23. The 4-inch lead S-trap in position; the top of vent-pipe half closed; no effect from 7.75 gallons discharged through the 4-inch outlet in the tank.

Number 24. The same trap; outlet of vent quarter closed; one discharge from tank through the 4-inch opening in the tank; water lowered five-eighths of an inch in trap.

Number 25. Same as Number 24.

Number 26. The same trap; the top of vent half closed; one discharge of 15.5 gallons through the 2-inch outlet of the tank. The water was lowered five-eighths of an inch.

Number 27. Same as Number 26.

Number 28. Same as Numbers 26 and 27.

Number 29. Same trap; same vent half closed; 15.5 gallons discharged through the 4-inch outlet of the trap. The air was drawn through the trap and 2 inches of water taken out. The seal was not broken. The trap was refilled.

Number 30. Same as Number 29.

Number 31. Same as Number 29.

Number 32. One discharge of 7.75 gallons, the top of vent being seven-eighths closed and the trap was siphoned.

Number 33. Same as 32.

Number 34. Same as Numbers 32 and 33.

A question of equal importance is, *are unventilated traps siphonable or are some varieties siphonable and others not so?* If some are unsiphonable and at the same time not affected by back-pressure it is important to know which they are. The following array of facts will answer the question:

In the following experiments the vent-pipe was closed, unless otherwise noted. The first tried were with the top of soil-pipe open and the fresh-air inlet closed.

[1] Report on experiments in trap siphonage at the Museum of Hygiene, U. S. Navy Department, Washington, D. C., and read as a paper at the recent Convention of the American Institute of Architects, by Glenn Brown, architect.

Number 35. A 3-inch lead S-trap was connected to one of the branches on the second story, and 15.5 gallons were discharged from the tank in the fourth story through the 4-inch opening. The confined air in the pipe between the running-trap and the descending column of water was forced through the trap, carrying the water with it. This passage of air continued as long as the water was flowing through the pipe from the tank.

Number 36. Same discharge from the tank. A small amount of water was blown out by back-pressure; then the trap was siphoned to 1¼ inch below the seal of the trap.

Number 37. Same as Number 36.

Number 38. Same as Number 36 and 37.

Number 39. Twenty-three gallons were discharged through the 4-inch opening in the tank The water was thrown up above the trap by back-pressure, playing above the trap like a fountain, a large part of it falling back into the trap, after which siphonage took place, as in experiment Number 36, leaving an eighth of an inch seal in the trap.

Number 40. A 3-inch lead S and a 3-inch lead U and a 1½ Sanitas trap were all attached to the same branch on the second floor. 15.5 gallons were discharged from the tank on the fourth floor through a 4-inch opening. The two lead traps were siphoned and half the water taken out of the Sanitas trap.

Number 41. Same as Number 40.

Number 42. Same as Numbers 40 and 41.

Number 43. The two lead traps were then cut off and the discharge sent through the pipe, the Sanitas S-trap was two-thirds emptied.

Number 44. Similar discharge without the trap refilling. The Sanitas trap was siphoned, only an eighth of an inch being left in the trap.

Number 45. A small 1¼-inch S-trap was inserted at the same place; 15.5 gallons discharged through the 4-inch opening in the tank. The trap was siphoned.

Number 46. The same trap was removed to the second floor and 15.5 gallons discharged through the 2-inch opening in the tank. The water was blown out of the trap.

Number 47. Same as Number 46.

Number 48. Same as Numbers 46 and 47.

The following experiments were made with the top of the soil-pipe and the fresh-air inlet both open, making a system of pipes the same as are now most commonly used in our houses:

Number 49. A large 4-inch S-trap and a 1¼-inch Bennor's trap were connected with the soil-pipe branch in the third story; 15.5 gallons discharged through the 2-inch opening in the tank. The Bennor's trap was not affected, while the 4-inch S-trap was completely siphoned. In this case the S-trap formed a vent for the smaller trap.

Number 50. The S-trap was removed and the same discharge made. The water was completely drawn out of the glass cylinder of the Bennor's trap.

Number 51. Another similar discharge without refilling the trap, and the seal was broken. The water would be drawn by siphonage beyond the ball into the cylinder, when the ball would take its seat, and the water would not pass back into the lower part of the trap. This shows the ball to be effective against the back-pressure in a new trap of this make.

Number 52. A Sanitas trap was put in at the same place; same discharge as above. Half of the water was taken out of the trap. The air passed through the trap rapidly, creating a continuous commotion in the water. The bulk of the water seemed to be thrown out against the separator in this trap and to fall back without passing out.

Number 53. Same trap; same discharge, one-eighth of an inch being extracted.

Number 54. Same as Number 53.

Number 55. A 1½-inch lead S-trap, Bower's 1¼-inch trap, and a 4 inch lead S-trap, all connected at the branch in the third story; a discharge of 15.5 gallons through the 2-inch opening in the tank. The Bower's trap was lowered to within a half-inch of the seal, the small S-trap to within 1 inch of the seal, and the large S-trap to within two inches of the seal.

Number 56. Same discharge; the S-traps not affected. A small amount of water drawn from the Bower's trap. The traps were not refilled.

Number 57. Same discharge; same effect on the S-traps. The Bower's trap was lowered to within an eighth of an inch of the seal. As soon as the air began to pass freely through the Bower's trap it acted as a vent for the two S-traps, the air finding its way into the soil-pipe.

Number 58. The small S-trap was removed and 15.5 gallons sent through the pipe from the 2-inch opening in the tank. The Bower's trap not having been refilled, was lowered to the seal; the air passing freely through it formed an excellent vent for the large S-trap.

Number 59. Same experiment, the Bower's trap partly closed; the S-trap was immediately siphoned, the seal being broken.

Number 60. Same as Number 59.

Number 61. The 4-inch S-trap in same position. The vent was connected with the 3-inch vent-pipe, 20 feet long, closed at the top; 7.75 gallons discharged through the 4-inch opening in the tank. The trap was siphoned, seal being broken, the elasticity of the air in the long vent-pipe having no effect in preventing siphonage.

Number 62. Same as Number 61.

Number 63. A 3-inch lead S-trap was attached to a double Y on the second story. 15.5 gallons were discharged through the 4-inch outlet of the tank, the running-trap was cut off, and direct outlet to sewer used. Half an inch was blown out of the trap; the trap was not refilled.

Number 64. Same discharge. A quarter of an inch more was blown out by back-pressure.

Number 65. Same discharge; one-eighth inch more blown out of the trap.

The following experiments were tried with the top of soil-pipe and fresh air inlet closed:

Number 66. The Sanitas trap was attached to the outlet in the second story. 15.5 gallons were discharged through the 2-inch outlet in the tank; the seal of trap destroyed by the back-pressure.

Number 67. Same as Number 66.

Number 68. Same as Numbers 66 and 67.

Number 69. Same trap; 7.75 gallons discharged through the 4-inch outlet of the tank; water first blown out of trap, then taken out by suction.

Number 70. Same as Number 69.

Number 71. Same as Numbers 69 and 70.

The following experiments were tried with the top of soil-pipe closed and the fresh-air inlet open:

Number 72. A large 4 inch S-trap was inserted in the third story, a Bennor's trap in second story, and 15.5 gallons discharged through the 4-inch opening in the tank. The seal of the 4-inch trap on the second story was broken, while the seal of the Bennor's trap on the first floor was not affected.

Number 73. Same as Number 72.

Number 74 Same arrangement of traps; 31 gallons discharged through the 4-inch opening in the tank. The S-trap siphoned, ¼ inch drawn out of Bennor's trap, S-trap refilled.

Number 75. Same arrangement of traps; 15.5 gallons discharged through the 4-inch opening in the tank. The S-trap siphoned, inch, drawn out of Bennor's trap, S-trap refilled.

Number 76. Same conditions. The water would rise slowly, the ball moving perceptibly until it passed over the top of the out-go, a small amount at a time. The vacuum in branch on the second story seemed to be caused by the friction of the column of water passing the branches, as it siphoned before the water column passed the branch.

Number 77. A 1½-inch Sanitas trap was attached to the branch in the third story, and a discharge of 15.5 gallons through the 4-inch openings in the tank. Half of the water was taken out of the trap.

Number 78. Same trap; same condit ons. Twenty-seven gallons were let out by accident, and the trap was lowered three-eighths of an inch below the seal.

Number 79. Trap was not refilled; 15.5 gallons discharged; one-quarter of an inch drawn out of the trap.

Number 80. Same trap; same discharge; one-quarter of an inch taken out of the trap.

Number 81. Same as Number 80.

Number 82. Same as Numbers 80 and 81.

Number 83. A 1½-inch Sanitas was put in same place; a similar discharge. The water was drawn completely out of the trap, leaving only a tablespoonful.

Number 84. Same conditions; 7.75 gallons discharged through a 2-inch opening in tank; same effect on the traps.

Number 85. Same trap was attached on the second story and 7.75 gallons discharged through the 4-inch opening in the tank; half the water was blown out.

Number 86. Same discharge; half the remaining water was blown out.

Number 87. Same discharge; only a sixteenth of an inch left in the trap.

Number 88. Same trap; same conditions; 15.5 gallons were discharged; three-quarters of the water was blown out of the trap.

Number 89. Same discharge; the whole amount of water was blown out, leaving only a trace

Fresh-air inlet closed; top of soil pipe open:

Number 90. A 5-inch lead S-trap was attached on the horizontal pipe on the first or ground floor, and Dececo, Boyles, Zane, and Meyers closets were discharged simultaneously with no effect on the trap.

Number 91. Six closets were discharged simultaneously with no effect on the trap.

Number 92. Small S-trap was inserted; no effect.

Number 93. Same as Number 92.

Number 94. Discharged 15.5 gallons from the tank; a small amount of water was blown out of the trap.

Number 95. Same as Number 94.

Number 96. Same S-trap was inserted in the second story and closets on first story discharged; no effects on the traps.

Number 97. Same as Number 96.

Number 98. Small lead S-trap inserted in third story and water-closets discharged on first story; no effect on the trap.

Number 99. Same as Number 98.

RECAPITULATION.

The Vent-Pipes on Trap Open.—In experiments Number 1 to Number 9 the top of the soil-pipe being closed, the only means of ingress for air to fill the vacuum is through the traps of their vents. This is the most severe test to which the traps can be subjected for siphonage. The fresh-air inlet being closed, the air in the pipes between the down-coming water and the running-trap must necessarily find its way out through the running-trap or through one of the traps connected with the soil-pipe. A strong current of air did, in every case, pass outward through the vent-pipe. Such strains would never occur in actual work unless the soil-pipe and fresh-air inlet should happen to become stopped. This is of rare occurrence in the top of the soil-pipe, sometimes happening from collections of snow or frost. The fresh-air inlet, as it is generally put in, may be easily closed by earth or dirt collecting on the perforated or grated opening. Experiments from Number 9 to Number 11: The fresh-air inlet was open; back-pressure was not great, while the siphon effect was the same. The condition of experiments from Number 11 to Number 34 were what would exactly have to be encountered in actual practice. The simple lead S-trap is acknowledged by all, to be the trap which is the most easily siphoned. It will be seen, by referring to the experiments from Number 1 to Number 34, that in no case was I able to siphon or force by back-pressure the seal of an S or any other kind of trap when it was properly vented. From that I conclude, that *traps, when Properly Ventilated, are not Siphonable.*

It has been asserted that when the vent is placed on the crown of a trap that in time it becomes choked up by refuse matter adhering to the surface. In these experiments the vent has been put in different positions, and it makes no difference in its effectiveness as long as it is between the trap and the vertical soil-pipe. With a little care the Y can be so placed and shaped that matter passing through the pipe would not adhere to the vent.

Experiments from Number 20 to Number 34 were tried with the vent on roof more or less closed. By these it can be seen that a vertical vent-pipe less than 3 inches, when the trap is connected with the 4-inch soil-pipe, causes a commotion in the trap, and a pipe of half its area with a discharge from the tank through a 2-inch opening in the tank drew five-eighths of an inch out each time. This discharge was no greater than would come from a bath-tub. The trap was completely siphoned when the outlet was seven-eighths closed, with a discharge equal to three plunger-closets.

When the Vents were closed. — From Number 35 to Number 99. All traps failed from either siphonage or back-pressure. The experiments from Number 35 to 48: The top of the soil pipe was open and the fresh-air inlet closed, in this way submitting the traps to the most severe strain they would have to withstand from back-pressure. Every trap failed except the ball-traps.

Experiments from Number 49 to Number 65 inclusive. The soil-pipe and fresh-air inlet being open were similar to the action traps would receive in every-day use. In every case the traps failed or siphoned, except the Sanitas.

I would call special attention to several experiments, Number 49 to Number 59. The discharge being 15.5 gallons through the 2-inch opening in the tank was hardly as severe on the trap as a discharge from a bath-tub. In every case except that of the Sanitas the traps failed.

In Number 49 a 4-inch trap similar to a hopper-closet trap and a small wash-basin; Bennor's trap, a combination often found in bath-rooms, and a large S-trap were siphoned by a discharge no greater than would come from a bath-tub in a story above. Such traps will always be used, and should never be put in without vent-pipes.

Number 55 to Number 60. Intended to represent a water-closet, wash-basin and bath-tub connection, water extracted from traps at each discharge, and the Bower's trap acting as a vent, the water was taken out to the seal at the third discharge. The wash-basin or bath trap was then partly closed, as would happen in actual use, by the plug, and the S-traps were siphoned by a discharge no greater than would come from a bath-tub in the fourth story.

Experiments Numbers 66 to 71 inclusive, were more severe than such traps would be subjected to, except in unusual contingencies — *i. e.*, the stoppage of the two air-inlets. All failed. These tests were no more severe than ventilated traps were subjected to.

In the experiments from Number 72 to Number 89 inclusive, the siphon action was greater than in actual practice, while the effect of back-pressure would be less, the air confined between the running-trap and the soil-pipe having free escape through the fresh-air opening.

Number 85 to Number 89 show how the air in the soil-pipe was forced through the trap. All the traps failed.

Experiments Number 90 to Number 99 were with discharges into a horizontal pipe on the ground floor. The traps were not affected, although the vents were closed.

Number 94 to Number 95. Water discharged from the tank in the fourth story, blew the water out of the trap.

Back-pressure seems, from the experiments, to be a more important feature in plumbing than is generally supposed. Although the fresh-air inlet was open, the air confined in the pipes almost invariably found egress more easily through traps on second and first floors than through the opening near the foot of the soil-pipe. No trap withstood back-pressure better than the others.

DEDUCTIONS.

(1) The seals of ventilated traps are safe against siphonage and back-pressure.

(2) The seals of unventilated traps are never safe from siphon action or back-pressure, except in deduction 4.

(3) The vertical vent should be three inches, with a four-inch soil-pipe.

(4) Traps connected on a horizontal pipe and fixtures discharging on the same level into horizontal pipe apparently have no effect on unventilated traps.

(5) All varieties of non-mechanical traps are more easily affected by back-pressure than by siphonage.

(6) The ball-traps were not affected by back-pressure, but by siphonage.

(7) The Sanitas trap withstood siphon action better than any of the patent-traps, but was easily affected by back-pressure.

(8) The sewer air is more liable to enter unawares by back-pressure through the seal of the trap, because the seal remains unbroken.

(9) Difference in friction of iron and lead pipes made no apparent difference in the effect on the traps.

The experiments will be continued as to other matters of moment.

Experiments have been made on evaporation of water in traps and the different methods of testing soil-pipes for leakage; but the matter is not yet sufficiently complete to put in this report.

Very respectfully, GLENN BROWN.

[Mr. J. P. Putnam, believing that the foregoing experiments were susceptible of a different interpretation, addressed himself to Dr. Turner, Medical Director U. S. N., in charge of the Museum of Hygiene, etc., where the experiments were made, to such purpose that the surgeon-general has authorized the publication of the following remarks of Mr. Putnam, and has promised that a copy thereof should be sent to every person who had received Mr. Brown's original document. To the unprejudiced mind the true, perhaps the only, way to get at the truth of this much vexed question is not for each investigator to make his experiments where and as he chooses, but for the upholders of the different theories to all meet in Washington, where there seem to be facilities for the work, and after agreeing on what experiments will really test the matter, make them and abide by the results. — EDS.]

THE necessity of enacting suitable plumbing regulations has lately begun to be keenly felt by our legislators and boards of health throughout the country. Following the example of a few large cities the smaller cities and towns are everywhere, in rapid succession, hastening to frame codes of plumbing laws, and the present is a time of unprecedented activity in this direction. Accordingly any measures tending to throw light on the very important subject under consideration, where light is greatly needed, are of the utmost practical value.

The most important question upon which a difference of opinion still exists, to the great confusion of the legislator, is in relation to the desirability of special trap-venting. The final solution of this question will practically turn the scales either in the direction of complication or of simplicity in plumbing. All admit that special trap-venting adds enormously to the complication, cost, and danger of defective work in our plumbing. It is, therefore, evident that it cannot be permissible, unless it can be clearly shown, not only that plumbing *can* be made safe *with* it, but also that plumbing *cannot* be made safe *without* it.

The tests which are now being made by Mr. Glenn Brown, at the Museum of Hygiene, and which have in part been published, form valuable accessions to the data necessary to enable us to decide the question, but have not been sufficient to justify their author in his conclusions. What was needed on his part was a careful comparison of these data with those heretofore obtained by other experimenters, and an intelligent and impartial interpretation of them all. A difference of opinion among investigators, particularly in this field, too frequently arises from a failure on the part of one to study the results obtained by others, as carefully as he should. The consequence is a disagreement on the part of those whose facilities for arriving at the truth are the greatest, and this disagreement not only confuses the public, but throws discredit on the experimenters themselves. I have endeavored, by a careful study of the apparatus and experiments of Mr. Brown, and by a personal interview with their author, to account fully for the difference of opinion existing between us.

I find, first, that Mr. Brown's experiments were made with apparatus and conditions which do not, and, in most cases, could not, exist in practice in plumbing; second, that in his comparisons of different traps with each other different conditions were employed, rendering the comparisons unreliable; and, third, that he has drawn his conclusions from insufficient data, ignoring facts which have an important bearing upon them.

Considering the matter more in detail we are forced to accept the following:

(1) The object of our test is to determine what adverse influences are liable to affect the seals of traps in good plumbing, and how to guard against such influences in the best manner.

(2) The trap-vent pipes used in Mr. Brown's tests are larger and straighter than those used in practice in house-plumbing under the trap-vent law. The pipes used by Mr. Brown were 3-inch, with 2-inch branches to the traps. His drawings are incorrectly made. They show the vent-pipes not more than half the size he actually used, and produce an erroneous impression on the very point under discussion, namely, the efficiency of the trap-vent pipes.

(3) The trap-vent pipes which are used in ordinary plumbing practice, in accordance with the present vent laws, would not be large enough to protect ordinary S-traps, such as were used by Mr. Brown, from the severe tests which he applied to them. We know that the reason why trap-vent pipes often fail in their duty, as they are now made, is because the air is retarded by friction against their walls in passing through them, and that the amount of this friction is increased as the size of the pipe is diminished, and as its course varies from a straight line. Siphonage acts with the rapidity of a flash, inasmuch as it is caused by a falling body of water as it passes suddenly by the mouth of the branch waste-pipe. The air must, therefore, as instantly be supplied, if it is to protect the seal of the trap. This it will certainly fail to do if it encounter any obstructions, such as are frequent in plumbing practice, either in a sharp bend in the vent-pipe, or in too great friction along its walls.

The 3-inch pipes show more correctly the true appearance of the vent-pipes used by Mr. Brown. At the right-hand side of the drawing is shown a trap-vent pipe run in a manner very common in ordinary practice under the trap-vent law. Such venting, even when new, has been shown to be far less effective than the use of a good anti-siphon trap, which, like the Sanitas trap, commended by Mr. Brown, may be made substantially self-scouring, and which has been repeatedly shown by numerous disinterested authorities to be proof against any siphonage that can be encountered in good plumbing practice.

(4) It would be useful to extend the tests at the Museum of Hygiene by using vent-pipes 1 inch, 1¼ inches, and 1½ inches in diameter, as used in practice, and varying in length between 5 and 25 feet. Such tests would then correspond with those made by Messrs. Putman and Rice for the Boston City Board of Health, and with those made at Worcester by the Worcester master-plumbers, in both of which series of tests ordinary traps fully vented lost their seals under siphonage no stronger than that applied by Mr. Brown,

while unvented anti-siphon traps held their seals under the same tests.

(5) Certain forms of unvented anti-siphon traps, including the larger pot or cesspool traps, would be capable of resisting a much more powerful siphoning action than S-traps vented in the manner shown in Mr. Brown's drawing, or as is usual in practice.

(6) Back-pressure may be easily guarded against by simpler methods than by trap-venting, one of which methods is to connect the waste-pipe of the trap with the soil-pipe at a point *beyond* the bend which causes the back-pressure. This can always be very easily done in practice. Another method is to set the trap far enough below the fixture to permit of the formation in the waste-pipe, above the trap, of a column of water long and heavy enough to resist the greatest back-pressure of air likely ever to be encountered in good plumbing. The trap must then be constructed with sufficient water capacity to fill such a pipe. In the experiments for the Boston Board of Health the length of pipe required in the worst cases which could be encountered in good plumbing was found to be from 14 to 18 inches. This method could always be easily applied in practice in places where back-pressure was expected, and the other method was not as convenient.

(7) It would be useful to make the tests last referred to on the apparatus at the Museum of Hygiene.

(8) The tests made by Mr. Brown, which broke the seals of the traps, were powerful enough to collapse and crush out flat the stout lead pipe through which the discharges were sent, so that it had to be replaced by another pipe. Such a fearful suction is evidently much greater than would ever be encountered in plumbing work, and rules for practice should not be based on such severe tests. Such tests are only serviceable as means of comparison between different traps or systems, and care should then be taken to apply precisely the same tests to each trap or system so tested.

(9) The only tests made at the Museum of Hygiene which were powerful enough to destroy the seal of the strongest anti-siphon trap, were those in which the main soil-pipe openings were closed as by snow or ice. Such closure, however, *would be equally, if not more likely to close also the mouth of the trap-vent pipe.* Hence, in those cases, trap-venting would be useless. It would fail, too, in the very cases where it would be most needed. Trap-venting is, therefore, not always relied upon as a safeguard.

(10) Waste-pipes and traps, especially under kitchen and pantry sinks, often become clogged or coated with congealed vapor and grease. Hence the mouth of the vent-pipe, wherever placed in them, must, and does often, become closed by such clogging. Here, again, the vent-pipe is rendered inoperative and unreliable.

(11) The water discharged from the tank in Mr. Brown's experiments was discharged by opening and closing a *solid plug without air-vent*, in the bottom of the tank, only a portion of the water in the tank being discharged at a time. This caused a very powerful suction, so powerful, in fact, that it was found exceedingly difficult at first for the assistant to manage the plug without injury to his hands. This kind of discharge would never occur in plumbing practice, since every plumbing fixture has, and must have, its overflow passage, and this supplies air during the discharge, and breaks the force of the vacuum. A plunger-closet produces an effect nearest in power to this; but the overflow-pipe, though small, is still sufficient to break the vacuum. Now the seals of the traps and overflows of plunger-closets are often destroyed by their own discharges in supplying air to break this vacuum, and the use of this kind of closet should never be permitted in plumbing practice. If the use of valve and plunger closets were prohibited by law the greatest cause of siphonage would be removed.

(12) As is the case with plunger-closets, so it is with other fixtures, such as wash-basins, when constructed, as they always should be, with outlets large enough to fill their traps and waste-pipes "full-bore," their own discharge will often destroy the seal of their traps, provided ordinary S-traps are used. This has frequently been demonstrated by myself and others. Hence, if the vent-pipe be used at all, it should be applied at the crown of the trap to protect it from "self-siphonage."

(13) If the vent-pipe be applied at the crown of a trap, as it should be in the case of S-traps, the ventilating current will rapidly destroy the seal of the trap through evaporation, and the vent becomes again unreliable as a protection against sewer-gas.

(14) Siphonage and back-pressure are supplementary to each other. The greater the power of the one at any place, the less that of the other. They cannot co-exist in full force at the same time and place, but stand in inverse relation to each other. Thus, where at the bottom of a straight soil-pipe just above an abrupt bend back-pressure is strong, siphonage is scarcely perceptible. Hence, in making comparative tests on different traps the same conditions of head and foot vents should be observed. This was not always done in the tests at the Museum of Hygiene, and a much more powerful test was applied to the unvented anti-siphon trap than to the vented S-trap. Mr. Brown's recapitulation should be entirely remodelled, in view of this and the other facts above enumerated. His Deduction Number (1) seems to be contradicted by his Deduction Number (3). For in the latter he admits that the vent should not be less than 3 inches in diameter to be efficacious. In practice they are rarely, if ever, found so large throughout their length. Hence in practice the vent is *not* efficacious.

From the above fourteen considerations we draw the following conclusions:

(1) The seals of ventilated traps are not always secure against the adverse influences liable to affect them in good plumbing.

(2) The seal of a properly-formed anti-siphon trap is secure against such adverse influences when properly placed in good plumbing.

(3) Where trap-vent pipes are large, straight, new, and not too long, they will afford protection against siphonage and back-pressure as long as they remain unobstructed. To make them large enough would involve a greater expense than would be justifiable in view of the result attained.

(4) Back-pressure may be easily and safely provided for by simple means without the aid of the trap-vent pipe.

(5) From the above considerations we conclude that special trap-venting is not desirable, the simpler system being safer and more economical.

I take pleasure in saying that Mr. Brown has consented to make the experiments above suggested on the apparatus, at the Museum, as soon as the weather permits, which will result, as have the tests of many other experimenters, in a further confirmation of the statements made herewith. Very respectfully,

J. Pickering Putnam.

To Dr. T. J. Turner, *Medical Director, U.S.N., in charge of Museum of Hygiene, Bureau of Medicine and Surgery, Washington, D. C.*

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

PARLOR IN THE HOUSE OF MRS. WILLIAM GAMMELL, PROVIDENCE, R. I.

[Gelatine Print, issued only with the Imperial Edition.]

SKETCHES IN THE HOUSE OF MRS. WILLIAM GAMMELL, POWER STREET, PROVIDENCE, R. I.

THIS house was built by one of Mrs. Gammell's ancestors (Mr. John Brown, a brother of the well-known benefactor of Brown University) A. D. 1786. Situated on the hillside east of the river — at that date it was most probably the farthest removed from the then fashionable quarter, now the old part of the town, at a lower level fronting the river — it was the pioneer of a number of proud family mansions in its vicinity, all more or less enriched with ornament and decorative treatment peculiar to that period. The house in question, built by one of a family of wealthy merchants trading with the Mediterranean and the East, bears the impress of a mind appreciative of foreign taste in art; and is for its size — in plan about fifty feet square, the L being modern — rather lavishly enriched with a number of white-marble busts, imported from Italy, as is also the soapstone mantelpiece in the drawing-room. The rococo ornament is not of so coarse a nature as is frequently to be observed in houses of a little earlier date, and, indeed the woodwork throughout possesses a delicacy and refinement more of the period of the Adams Brothers, though possibly executed in French workshops.

ACCEPTED DESIGN FOR THE ALGONQUIN CLUB-HOUSE, BOSTON, MASS. MESSRS. McKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

APPARATUS USED FOR THE EXPERIMENTS ON TRAP-SIPHONAGE CONDUCTED BY MR. GLENN BROWN, ARCHITECT, AT WASHINGTON, D. C.

THE TREATMENT OF SEWAGE.[1]—IX.

I NOW approach the really practical question, asked all over the country, from every sanitary authority, often in tones of painful despair, viz., "*How shall we deal with our sewage?*"

And here let me say, there is no one answer that can be given to this question. The adviser, to advise fairly, must be prepared to sink his hobby, be it the hobby of precipitation or the hobby of irrigation, remembering that whilst conditions favorable to his hobby may exist at one place, conditions absolutely unfavorable may exist at another. Further, it is of no use telling how some pet plan, say, of irrigation or of precipitation, has succeeded at some one place or another, persuading local authorities to undertake a pilgrimage of inspection (although they are usually ready enough to do) and arguing that

[1] A paper by Dr. C. Meymott Tidy, read before the Society of Arts, April 14, 1886, and published in the *Journal* of the Society. Continued from No. 576, page 23.

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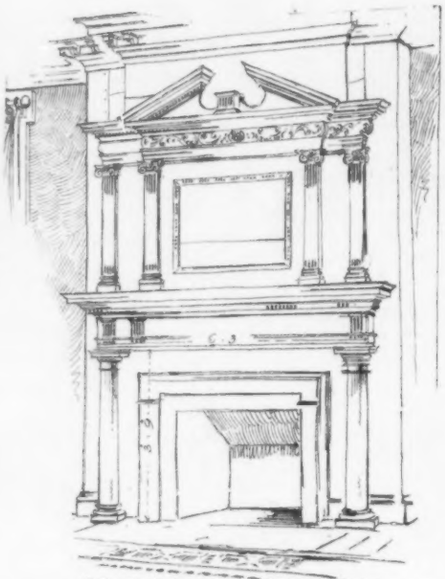
in the Parlor



Mantelpiece on Second Floor

Door-head in Hall.

Door-head in Parlor.

Morning-Room.

Mrs. William Gammell's House. Providence. R.I.

Sketches by E. Eldon Deane.

Heliotype Printing Co. Boston.

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Mrs. William Gammell's House. Providence, R. I.

"The Approach"

The Staircase.

Heliotype Printing Co. Boston.

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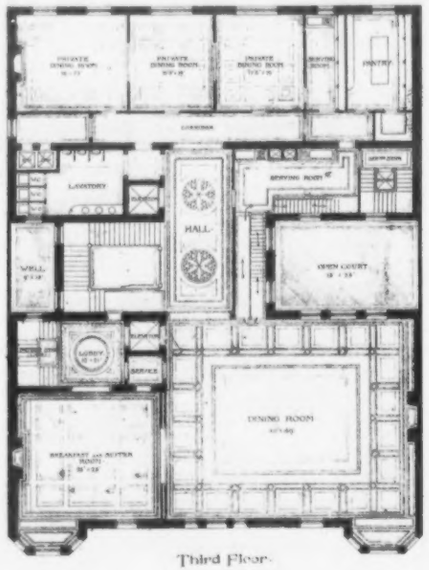

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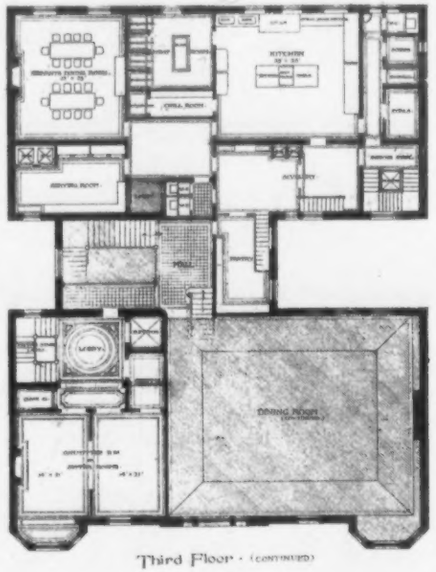
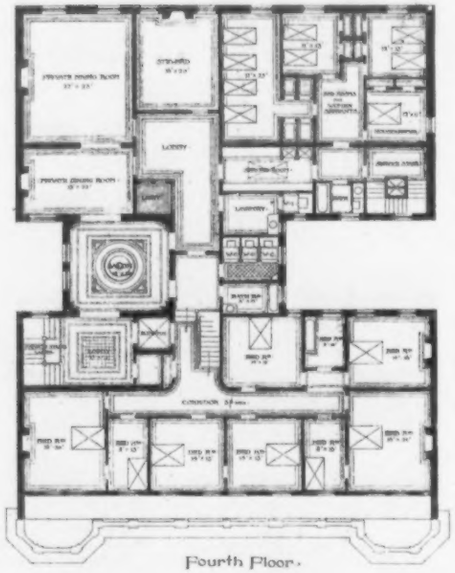


Third Floor. (CONTINUED)



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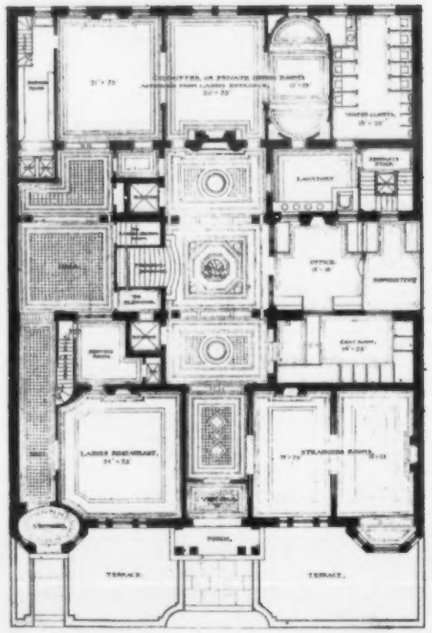
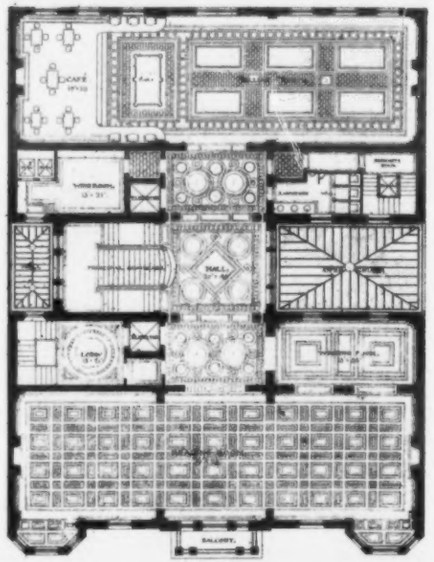
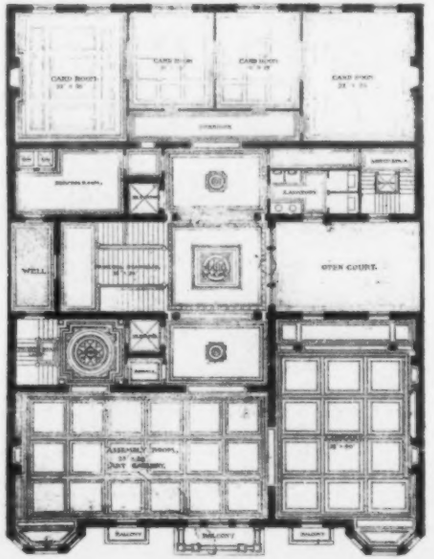


Ground Floor.

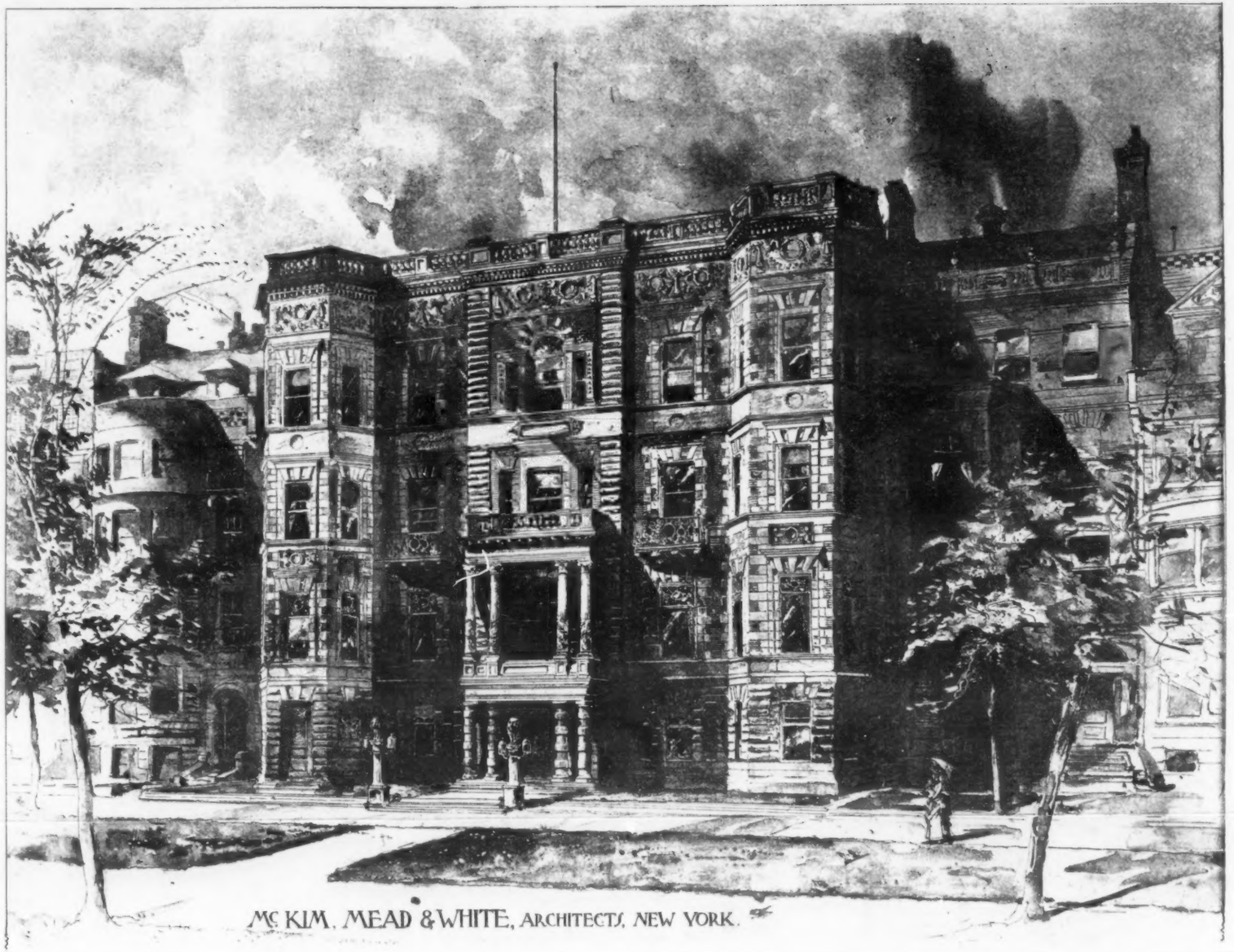


First Floor.



Second Floor.

Ground Floor.



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ACCEPTED DESIGN FOR THE ALGONQUIN CLUB HOUSE, BOSTON, MASS.

No. 577 American Architect and Building News, Jan. 15 1887.

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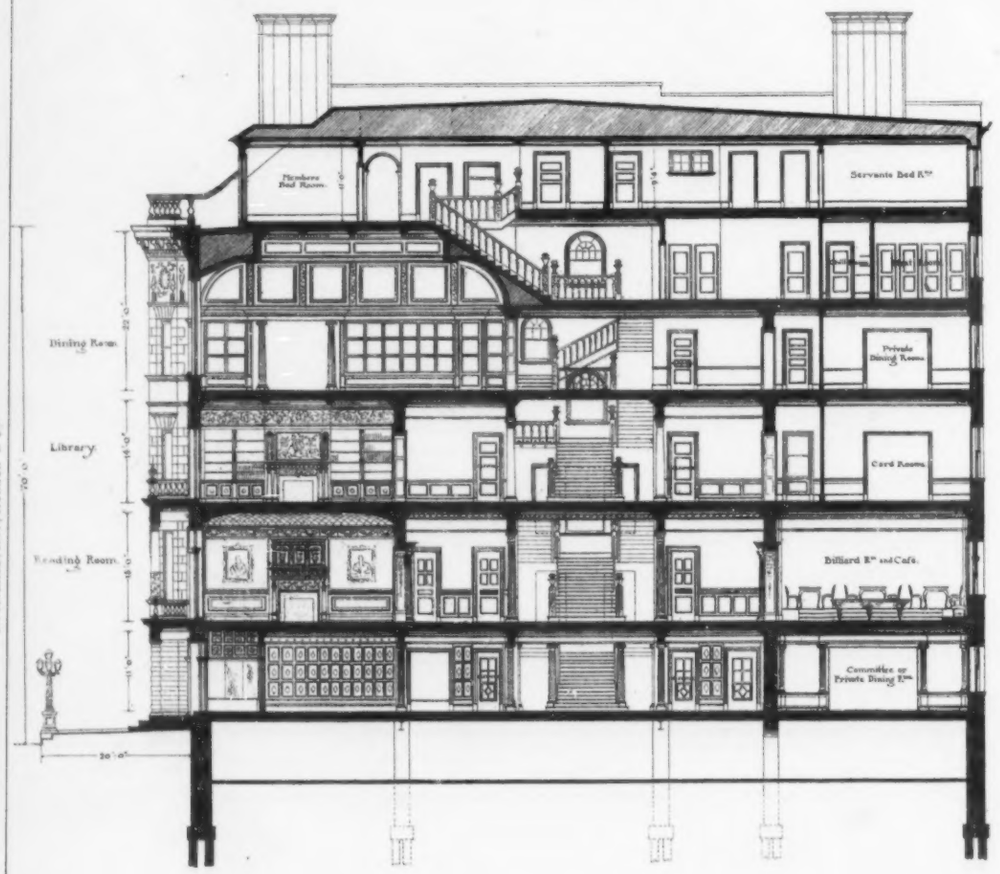
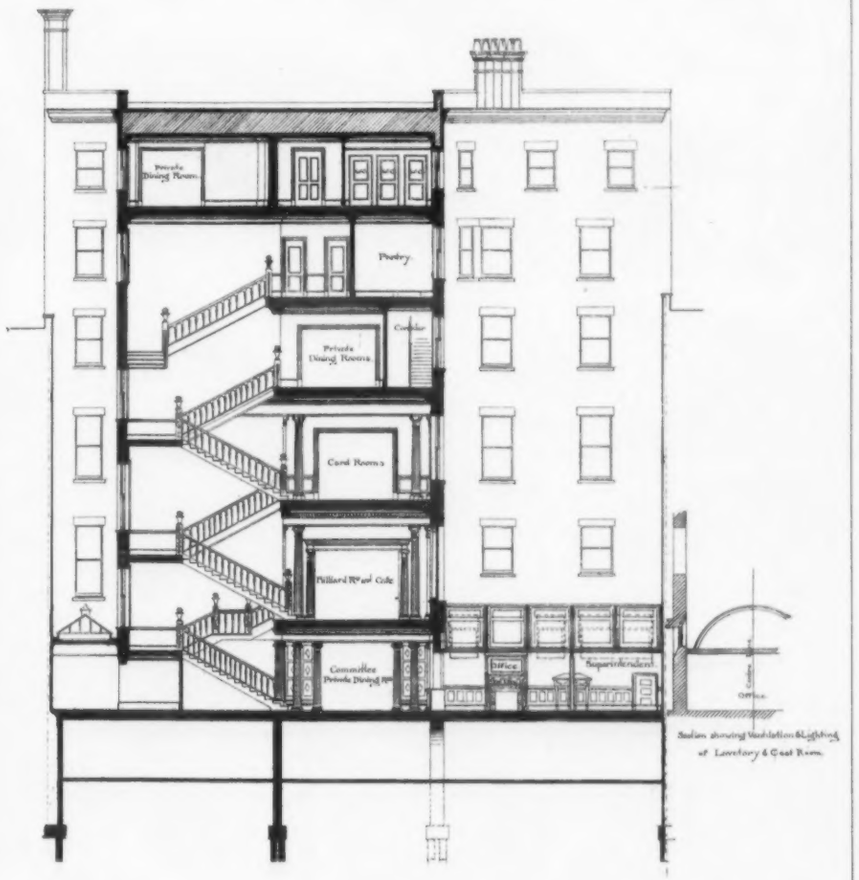


Longitudinal Section.



Transverse Section.

ACCEPTED DESIGN FOR THE ALGONQUIN CLUB HOUSE, BOSTON, MASS.

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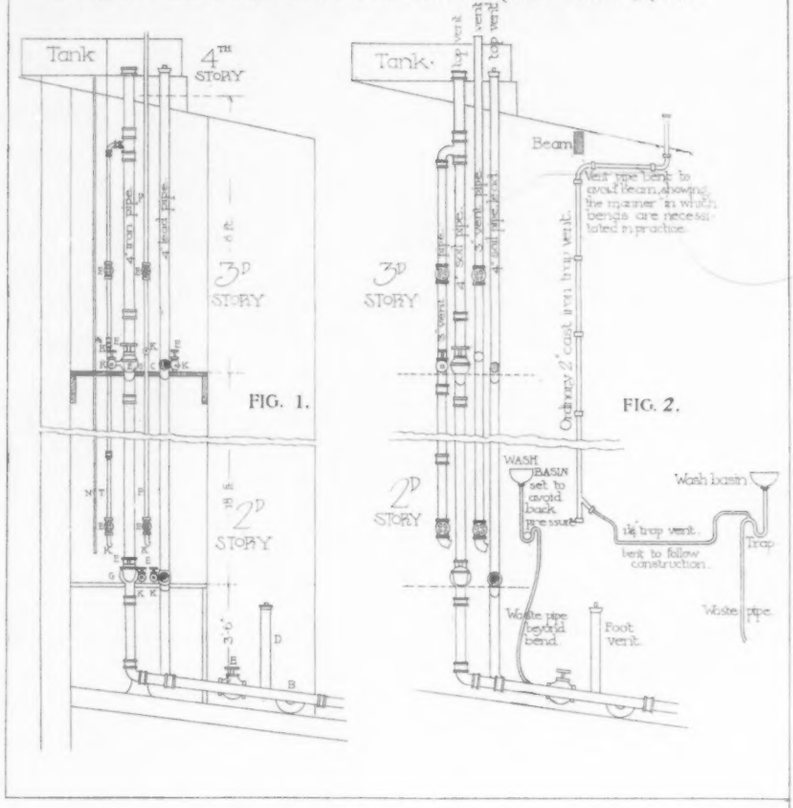
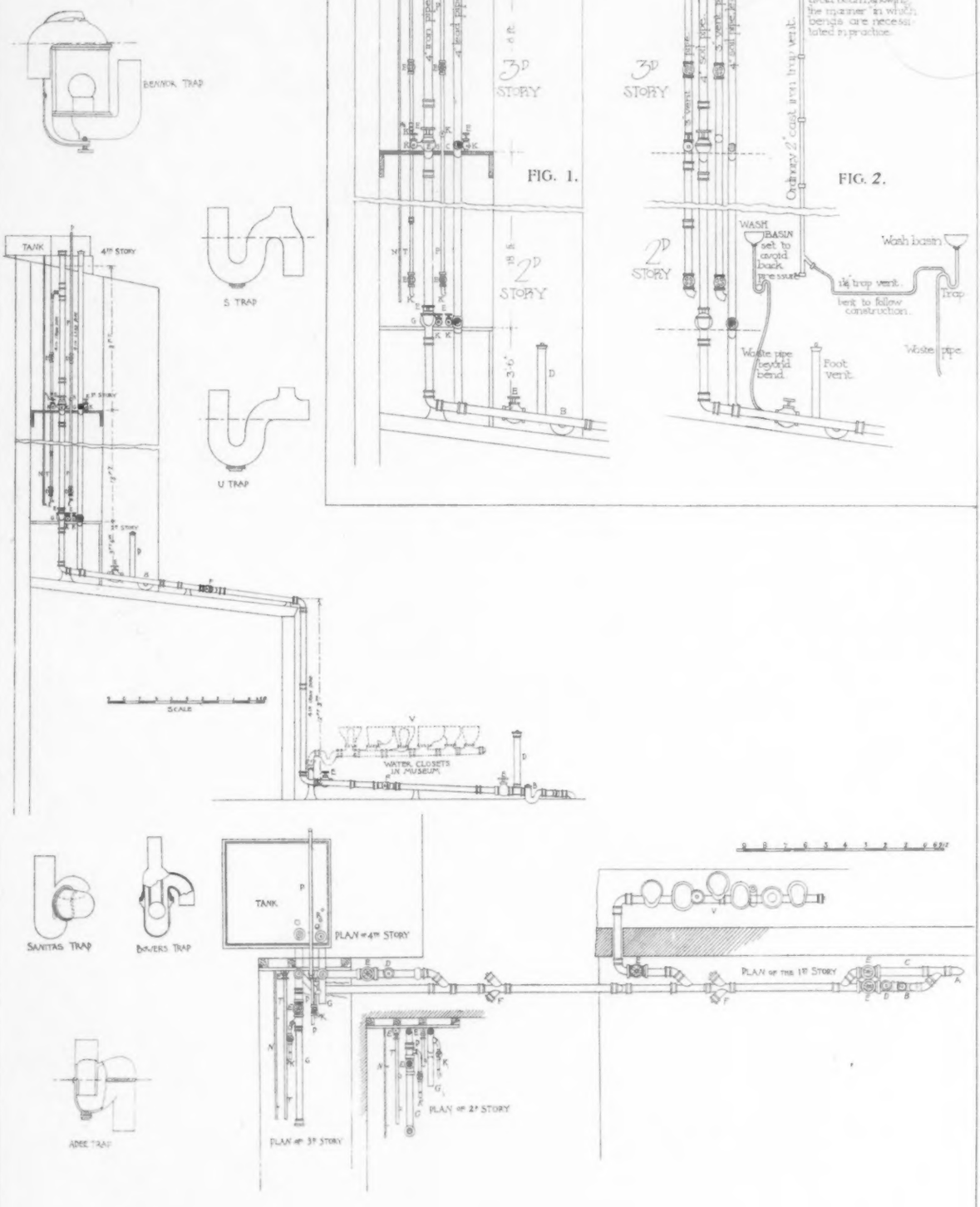
DIAGRAM ILLUSTRATING Mr PUTNAM'S REPLY TO Mr BROWN.





EXPERIMENTS IN TRAP SIPHONAGE AT THE MUSEUM OF HYGIENE, U.S. NAVY DPT.

WASHINGTON, D.C. BY GLENN BROWN, ARCHT

Heliotype Printing Co. Boston.

because such and such plan has succeeded at A, therefore it will succeed at B. There is no universal remedy for the sewage difficulty, and no one plan of treatment to be laid down.

When people say, "The whole thing is easy enough, only do this or do that," be certain they have not grasped the difficulties of the subject, and I fear, know little about it.

Let me attempt, however, to suggest certain fundamental propositions that may serve as a starting-point in advising local authorities:

1. Towns must be prepared to pay to be clean. You will never be able to make your sewage pay your rates; on the contrary, experience shows that you must purify your sewage at the expense of the rates.

2. That health demands that your sewage should be got rid of, and purified at any cost. Minimize the cost, but pay you must for purification. Hence, you must be prepared not only to borrow money to erect works, but for an annual expenditure after the works have been erected.

3. That no matter how perfect your works, your sewage will require constant attention, Sunday as well as week-day, night as well as day.

4. That to let unpurified sewage pass into a stream means passing your filth on to your neighbors. Sewage ought to be treated where the sewage is produced, as far as it is possible. And, considering this aspect of the subject, let me add, litigation is a more expensive luxury than sewage treatment, and breeds, if possible (although on this I admit a doubt), more ill-will.

5. That although our duty is to do our work well, at as small a cost as possible, we neither require (*quâ* the effluent) to produce a drinking water, nor (*quâ* the sludge) to produce Peruvian guano.

Our sewage has to be treated. We shall necessarily inquire how much sewage there is to treat, and what kind of sewage it is.

Let me suppose that our first thought is the possibility of an irrigation scheme.

Far be it from me to say that irrigation may not prove successful. But it is fair to note that, to attain the end of a sanitary authority, experience has shown that the sanitary authority must itself be the proprietor of the land. If you give the sewage to the farmers (supposing they would accept your gift) the interests of the local authority and of the farmers are opposite. For it is manifest that the interest of the farmer is his crops, whilst the interest of the local authority is the purification of their sewage. The local authority, as a sanitary authority, must demand a pure effluent at all times, in winter and in wet seasons as well as in summer and in dry seasons. Between these divided interests of farmer and sanitary authority, the question of purity of effluent may, and in our experience usually does fall to the ground. Hence, if irrigation is to be adopted, the local authority must provide its own land for the purpose.

Sundry questions at once arise:—

1. Is it practicable to obtain *sufficient* land, and land *properly constituted* as regards general character, level, etc., for irrigation purposes? Let me note that the word "sufficient" is not capable of precise definition. What is sufficient in the case of one kind of land is insufficient in the case of another. What is sufficient land with one kind of engineering treatment, and with one kind of sewage would prove insufficient with another kind of engineering treatment, and another kind of sewage.

2. Is this properly constituted land reasonably *near* to the town, so that the cost of conveying the sewage to the land will not be excessive, but at the same time reasonably *distant*, so that the town may not derive injury from the nuisance likely (we might almost say certain) at times to result?

3. Is the land of such a level as to necessitate pumping? Is it near a water-course, canal, railway, etc.?

Let me suppose these questions answered satisfactorily. A very serious further question has now to be considered, viz., where is the effluent to be discharged?

The importance of the question is this. In all irrigation schemes, of whatever nature, we are dependent for effective purification on effective land in effective order. The action of land may become ineffective from circumstances over which we have no control, viz., *frost*, where the ground may become absolutely impenetrable, and *water-logging*, in times of heavy rains, when the sewage is in far greater quantity than normal, and for a time at least more foul than normal, from flushing of the sewers.

Hence, if the outfall is into a river where considerable purity, and unfailing continuity of purity is demanded, an irrigation scheme is, to say the least, unsafe. If, however, the discharge be into the sea, or into a tidal estuary, or into a stream, where the occasional discharge of a little doubtful water is unimportant, an irrigation scheme, pure and simple, may pass muster.

To secure land for a sewage-farm (even after the proper land has been found) is not an easy matter. It often means a fancy price. It means, too, a mass of opposition from adjoining property-holders, who suddenly discover that all the fields in the vicinity of the land selected are building ground.

I do not mean this as an objection peculiar to land required for irrigation purposes.

Another matter has to be considered. If land be taken on lease for a sewage-farm, its renewal may prove difficult. The lease of the Croydon farm expires in 1892.

I will at once admit that my own experience has led me to the opinion that greater advantages result from a combined process of precipitation and irrigation than can be obtained by either method independently, admitting as I do to the full, that a good effluent may be obtained by a precipitation process alone, nearly as good, in fact, as any effluent that can be obtained by irrigation. A precipitation scheme by itself has these two enormous advantages over irrigation, viz. (1) its efficient working is totally independent of weather, and (2) that, if sufficiently large works be erected, any emergency of quantity can be met. Precipitation has had its greatest enemies in its most earnest advocates. Extravagant advantages have been claimed for it. The sludge has been advertised as of enormous manurial value. Patents by the hundred have been taken out. Precipitation advocates have been for the most part advocates of a system in which they are interested. And there is no wonder that distrust in precipitation schemes have arisen, when the *claims* put forth by enthusiasts and patent-mongers have been weighed in the balance against the *facts*, and found wanting.

Supposing, then, we determine on a precipitation process, there arises the first great question, *what precipitant shall be used?* Here two points must be considered. At any rate it will not be disputed:—

1. That, consistently with efficiency and purity of effluent, the chemicals should be cheap.

2. That the smallest quantity of chemicals that experience proves is capable of doing the work properly should be added to the sewage, so as to minimize the quantity of sludge formed.

I am anxious to be in no sense the advocate of any one system of precipitation. I will admit, however — the process now is not a patent, and if it were I should speak with greater caution — that the A B C turns out the best effluent with which I am acquainted. My own experience leads me to speak very highly indeed of the combined use of lime and sulphate of alumina. The quantity of lime which is to be added first should be such as to render the sewage faintly alkaline. Probably at the rate of from five to seven grains per gallon will be needed for this purpose. It should be added as milk of lime, and should be thoroughly stirred in by means of a paddle-wheel, or other efficient mixer. A flow of a few yards should now be allowed to permit the aggregation of the precipitate. This having taken place, a solution of crude sulphate of alumina, in the proportion of about five grains of sulphate of alumina, is to be added, and the sewage again actively stirred. In the alkaline condition of the sewage, the alumina will be precipitated, and will then combine with a portion of the organic matter, forming together an insoluble precipitate. Thus treated the sewage should be allowed to flow into tanks for the precipitated matter to collect.

Let me attempt to indicate the effect of such treatment. A portion of the lime will be at once converted into carbonate of lime, by combining with the carbonic acid present in the sewage, and serve as a weighting material to aid in the deposition of the lighter flocculent materials. This mechanical action of the lime carbonate is of great importance. The flocculent suspended matter is no doubt one of the most important materials to remove, because it is that ingredient of the sewage which readily putrefies, and in this way causes a nuisance. It is, moreover, so light that, unless weighted, it is difficult to precipitate. A second portion of the lime combines with some of the organic matter in solution, producing an insoluble precipitate (of uncertain composition) of a compound of lime and organic matter, the subsidence of which is again assisted by the formation of the carbonate of lime previously described. A third portion of the lime renders the sewage slightly alkaline.

The alumina salt is now to be added. The alumina is precipitated, owing to the alkalinity effected by the slight excess of lime. This alumina combines with some of the organic matter in solution, not precipitated by the action of the lime. The power of alumina in combining with dissolved organic matter, and so removing it from solution, is taken advantage of in many commercial processes.

Respecting the iron salts, one strong objection to their use is, that if the effluent be discharged into a river, the stream is liable to be blackened from the formation of a sulphide of iron, a condition likely to be mistaken by the general public for a sewage deposit. I have therefore, of late, admitting the value of iron compounds as precipitants, hesitated to recommend their use, save under very exceptional circumstances. As regards the use of phosphates as precipitants, the effluent is almost certain to contain some phosphoric acid, which greatly aids the growth of low forms of fungoid growths amongst which may be included the so-called sewage fungus.

It is advisable that the effluent, before its discharge into a stream, be at least neutral, and preferably slightly acid. This condition is easily brought about by the addition of a small quantity of acid to the effluent before its escape.

The effluent after treatment, will no doubt have a slight odor. This is not, however, a sewage smell. If in this condition of comparative purity — indicated by absence of color and freedom from suspended matter — it be allowed to flow over and through a small area of land (a loamy sand or gravel by preference) to serve as a chemical filter, high degree of purity may be obtained, and the finer finishing touches of purification effected.

The evils of irrigation under such circumstances do not arise. Such a filtration of the effluent (1) cannot produce a nuisance, because it contains no foul suspended matters to collect on the surface

and putrefy; (2) it cannot clog the ground, because the gelatinous and *papier maché* matters in solution have been removed; whilst (3) it has a certain manurial value, the quantity of ammonia in solution being not much less than that of the original sewage.

Again I may quote from Dr. Monro's paper, who, it will be remembered, doubts the advisability of ordinary irrigation as a general process, on account of impervious deposits choking the pores of the land. He says, "The removal of the suspended matter, however, from the sewage, renders irrigation much more practicable. With a clear effluent and a porous soil, the nitrifying power brought into play is enormous, and a moderate area of soil, whether of grass land or arable, can deal with large and almost continuous doses of sewage water." Dr. Monro points out that the presence of objectionable organic matter is as destructive to nitrification as the clogging of the soil, or a great lowering of temperature.

The following Table will give some idea of the cost of chemical treatment of water-carried sewage:

Table showing that the Cost of Chemical Treatment of Water-carried Sewage at the outfall varies according to the foulness of the Sewage operated upon, and that such cost is influenced by the number of water-closets in use. It will be observed that water-closets increase the cost of chemicals at the outfall and lessen the cost of cleansing privies, pails, or middens, but that this increased cost of chemicals is less than that thrown on the rates by the cleansing and removal of the contents of privies, pails, or middens.

Name of Process.	Where used.	Population.	Number of w. c.'s in use.	Number of privies or middens, etc., in use.	Quantity of refuse removed yearly from privies, middens, etc.	Annual cost of emptying privies, middens, etc.	Cost per million gallons for chemicals.	Cost per head per annum for chemicals.	Cost per head per annum for emptying privies, etc.	Total cost per head per annum for chemicals and emptying privies, etc.
						£	s. d.	d.	d.	d.
Alumina, iron, etc.....	Coventry	42,000	6,000	150	7,000 loads	1,050	19 10	4½	6	10½
Alumina, iron, etc., sewage if dye were absent.....	Coventry	42,000	6,000	150	7,000 loads	1,050	12 6	3	6	9
Precipitation by lime and coke filtration.	Bradford	197,000	10 ₱ ct.	90 ₱ ct.	50,200 tons	8,000	11 0	2	9¾	11¾
Lime process	Leeds	320,000	13,729	43,000	80,000 loads	12,333	10 9	1½	9½	11

I may be asked what quantity of land is needed where sewage has been efficiently precipitated. Again the answer will depend on the nature of the land. But if I say an acre to every 5,000 to 7,000 people, I am well within the results of my experience.

Sewage works of the kind I have mentioned can be carried out without the slightest nuisance. The mixing should be done in closed wells. The mixture, as it flows into the tanks, should, if sufficient chemicals have been used, be as free from odor, at the distance of a few feet from the mixer, as common water. The land cannot possibly produce noxious effluvia or poisonous vapors, because the sewage has already been treated with antiseptic precipitants.

Of course all depends on the treatment having been efficient. Success in the treatment of sewage obeys the same laws in this respect as success in anything else.

I am desirous here of pointing out certain details of treatment essential for the success of a precipitation process:—

1. It is necessary that the sewage treated should be *fresh*—by which I mean sewage in which active putrefactive changes have not taken place. Perhaps, speaking generally, the sewage should not be more than 48 hours old for effective precipitation. But it is certain that, with a sewage of not more than 24 hours old, a far better result, with a smaller amount of chemicals, can be obtained. In fixing, however, the time, a certain elasticity must be allowed, an elasticity by way of extension in winter and of compression in summer.

I have said the treatment should be effected *before* active putrefaction commences. In sewage, the decomposition of the different constituents takes place at different times, in some cases the periods of active change being separated by periods of practical rest. Thus, a certain alteration in sewage takes place almost immediately. This results (amongst other changes) in the breaking up of the urea, and the formation from it of carbonate of ammonia. It is a rare thing, indeed, for any sewage, when it reaches the sewage works, to contain more than a trace of urea. No nuisance results from this change of the urea. A considerable interval occurs before any other putrefactive stage occurs, and it is during this interval when the precipitation should be effected. If this period be allowed to pass, increased difficulty in working results.

2. The straining of the sewage before treatment, in order to remove rags, corks, and the various *et ceteras*, such as dead rats, walking-sticks, etc., that come down along with the sewage, is advisable but not essential, in order to prevent accumulations on the surface of the tanks. Fixed wire gratings are objectionable, on the ground of their becoming so easily choked. Baldwin Latham's extractor is employed in several places with success.

3. It is essential that sufficient chemicals be employed to effect complete precipitation, disinfection and deodorization of the sewage.

No greater mistake can be committed than to starve the chemicals. To this must be attributed many cases where a precipitation process has proved a failure. A local authority will spend a large sum in erecting works, perfect in architectural detail, excellent for sewage treatment, whilst they shirk a small annual payment for the necessary chemicals. I need scarcely point out that efficient works will not purify sewage. They are but the means to an end. It is better to calculate the amount of chemicals to be used on the population than on the quantity of sewage.

4. It is essential that after the chemicals are added, the mixture should be well stirred. The chemist understands the value of the stirring-rod in order to effect perfect chemical contact. My own experience is that the chemicals added to sewage are often wasted from insufficient stirring. Not only is it the case that they do not precipitate so much as they might, but the process of flocculation is imperfect, and the difficulty of obtaining a clear effluent correspondingly great.

5. It is essential that there should be sufficient tank accommodation. Let me note, sufficiency of tank accommodation is necessary for two reasons:—

(1) That the precipitate may subside perfectly, and leave a clear, colorless effluent. Shallow tanks, with considerable velocity of sewage through them, or insufficient tank accommodation, means imperfect subsidence. Imperfect subsidence means the discharge of a certain quantity of flocculent organic matter in the effluent (the mineral matter being more likely to be deposited from its greater specific gravity), and which flocculent matter is likely to occasion nuisance from its decomposition. The treated sewage should flow through at least two subsiding-tanks in series, the first being capable of holding one hour's flow, and the second not less than four hours' flow. The tanks should be at least four feet deep, and the overflow of the defecated sewage should be over a weir, not more than half an inch below the surface. There should be a double set of tanks for successful working.

(2) Sufficiency of tank accommodation is also important, so that the sludge may be frequently removed, otherwise the freshly precipitated sewage may be contaminated by the decomposing materials of a previous precipitation, or a nuisance result from a collection of decomposing matter. Many a good effluent is spoiled by foul materials being allowed to collect in the subsiding tanks. These materials undergo putrefaction, the gases given off contaminating the effluent. The solid matters, becoming specifically lighter than the liquid, by the gases of putrefaction developed in and amongst them, rise to the surface, the floating black masses presenting an objectionable appearance, and discharging offensive products into the air. After a time these black masses sink, and thus, by constant commotion of the precipitated matters, a turbid effluent, with a more or less foul smell, results.

6. That the defecated water should flow through a shallow open conduit of not less than a quarter of a mile before being discharged into the stream.

7. The stream into which the effluent is discharged should have a free run, and in volume be not less than eight times the volume of the defecated sewage.

8. That the tanks themselves should not only be emptied of the sludge, but thoroughly cleansed before being refilled.

The extent of tank accommodation needful will depend a good deal on the dilution of the sewage to be dealt with, either by subsoil or surface waters, or by both, and whether the treatment employed be intermittent or continuous. The following gives the tank capacity provided at certain successful works:—

Precipitation Tank Capacity.

Place.	Treatment.	Population.	No. of tanks.	Capacity in gallons.	Gallons. per head
Bradford.	Intermittent	200,000	34	612,000	3.06
Coventry.	Intermittent and continuous	45,000	8	1,000,000	.22
Hertford.	Continuous	7,747	6	318,000	.41
Leyton...	Continuous	40,000	4	1,000,000	.25

The most suitable depth for tanks is from five to six feet.

It may be worth noting the rate at which the precipitated matters deposit when the treatment with lime and sulphate of alumina is efficient, and the sewage collected in tanks of 5 feet 6 inches. The water begins to clear a few minutes after the cessation of agitation. In thirty minutes it clears to a depth of 3 feet, with 8 inches precipitate, while after two hours the precipitate will measure 4½ inches only.

From the above Table it will be seen that if the proportion of water-closets at Bradford and Leeds was larger, the cost of chemicals at the outfall must be considerably increased. If, on the other hand, the proportion of water-closets at Coventry was as low as it is at Bradford and Leeds, the cost of chemicals could be considerably reduced, and would probably not exceed 8s. or 9s. per million gallons. From this it will be seen that Alumina treatment, such as that employed at Coventry, is cheaper than lime treatment; and it has already been shown by official investigations that lime treatment and its modifications are not as efficient as, or equal in sanitary results to, alumina treatment. It is, moreover, still more expensive than is shown in this Table, because of the large residue it produces twice the quantity of sludge as alumina treatment does, the dealing with and disposal of which has a very costly matter, particularly as it is practically useless as a manure, and not so readily saleable as that produced by alumina treatment.

All this accomplished, two questions remain: (1) Have you produced such an effluent that it will not pollute the water-courses? (2) Is not the sludge certain to cause a nuisance?

That a clear, colorless, non-frothing effluent can be produced by mere chemical precipitation, is not a matter of opinion but of fact. That an effluent absolutely without smell can be produced, I doubt. The smell, however, of the effluent from properly treated sewage is not the odor of sewage. I have never, I candidly confess, found an effluent without a certain smell. I have heard a well-known authority ascribe it to the presence of minute traces of essential oils or strong-smelling bodies (*e. g.*, onions), difficult of removal by precipitants. If the effluent is to be discharged into the sea, or into a tidal or large river (say two hundred or three hundred times the volume of the effluent), this odor is absolutely immaterial; but where great purity is required, *e. g.*, when the effluent has to be discharged into a small stream or into a river employed at a short distance from the outfall for drinking purposes, some further treatment is called for.

Such further treatment consists either (1) in the use of artificially prepared filter-beds, such as are used for the filtration of water, or (2) by filtration through a small area of land.

Of these two methods, I prefer the latter. After careful consideration, I consider that for this purpose an acre to every 5,000 to 7,000 people (as I have before noted) is abundant. I shall not discuss any question of manurial value, although I may point out that the ammonia of sewage is not appreciably affected by ordinary chemical precipitants.

(2) Is not the sludge an inevitable cause of nuisance? I confess it may be, and often has been. Allowing the sludge to accumulate week after week in the depositing-tanks, is not only an evil (as I have pointed out) so far as our endeavors to procure a good effluent is concerned, but an unmitigated nuisance, so far as relates to the sludge. Further, the old method of emptying the sludge into open sludge-pits, where the liquid portion was allowed to drain away and to evaporate, has proved a constant cause of just complaint, more especially in warm weather. I am not sure whether the sludge, under these conditions, was not sometimes a greater nuisance after being taken out of the sewage than when left in it. Until lately the difficulty of the disposal of the sludge was one inherent to all precipitation works. Until lately, I said, because now the difficulty is overcome.

I am indebted for the following table to the manager of a sewage works in a residential neighborhood of a population of 18,000. The process used is lime and sulphate of alumina. The sewage is pressed in one of Johnson's presses: —

Sludge.	Amount per day in tons.	Amount per annum in tons.	Amount per million gals. of sewage in tons.	Amount per million gals. of sewage proper in tons.	Am'nt per head of population per annum in cwts.	Cost per ton.
Wet ...	33.75	12,319	44.53	67.5	13.7	10d.
Pressed	6.04	2,205	8	12	2.45	4s. 7d.

The record of sludge begins on February 16, 1885, and ends on February 16, 1886. The wet sludge is got by a series of eighty different actual measurements on various days throughout the year. The pressed sludge is got by keeping a record of the number of times the presses were emptied on every day in the year. A cubic yard of wet sludge is taken as weighing .98 of a ton, and a cubic yard of pressed sludge as weighing .75 of a ton (actual determinations).

The following details are taken from Mr. Lacey's Report to the Brentford Local Board, on "The disposal of Sewage Sludge":

THE DISPOSAL OF THE SLUDGE AT VARIOUS TOWNS.

I. Left to dry in open pits and given or sold to farmers.	II. Run on land, or dug in and deposited.	III. Mixed with house refuse and given to farmers, or used on own land.	IV. Partly air dried, and burnt in kiln.	V. Dried, and made into cement.	VI. Pressed in filter presses.	VII. Mixed with house refuse and burnt in destructor.
Atherton, 12,602* Bacup, 25,054 Burton-on-Trent, 41,500. Chester, 37,000. Ely, 8,171 Derby, 89,690. Leicester, 130,000. Luton, 28,000. Over Darwin, 36,000. Twickenham, 13,200. Taunton.	†Birmingham, 605,000 Redditch, 10,500. Royal Leamington Spa, 24,000. Walthamstow, 30,000. Windsor, 12,500.	Epsom, 8,000. Northampton, 55,000. Wellingborough, 14,000.	Salford, 180,000	Burnley, 68,000.	‡Croydon Rural, 25,000. §Coventry, 47,000. ‖Leyton, 38,000. ¶Wimbledon, 20,000. **Chiswick.	Ealing, 18,000.

* The number after each town is the estimated population.
† 479 cubic yards daily; 1 acre of land used weekly; treatment repeated every third year.
‡ Sold at 1*s.* 6*d.* per ton.
§ Cost of pressing per ton of cake 2*s.* 6*d.* Sold at 2*s.* 6*d.* per ton.
‖ Cost of pressing per ton of cake 1*s.* 8*d.* Cleared free of cost.
¶ Cost of pressing per ton of cake 3*s.* 6*d.* to 3*s.* 9*d.* Sold at 1*s.* per ton.
** Cost of pressing per ton of cake 3*s.* 4*d.*

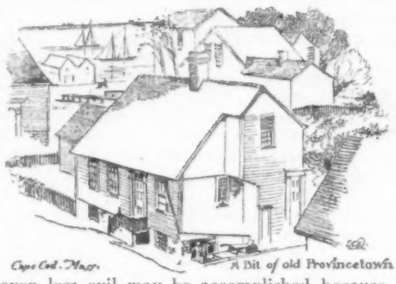
It is essential, both in the interests of the effluent and of the sludge, that it should be frequently removed from the tanks — I mean that the sludge should be removed before putrefactive decomposition sets in. This frequent removal is necessary (1) so that the effluent may not be polluted, and (2) so that no nuisance may result during the removal of the sludge and the cleansing of the tank. For here I must express a strong opinion that it is not enough merely to empty the tank of sludge, but it is imperative that, after being emptied, and before being refilled, the tank should be well cleansed; in other words, that the matters which stick to the sides of the tank should be completely and efficiently removed, to prevent nuisance or fouling by subsequent decomposition.

It would be outside my province to deal with the methods of raising the sludge out of the tanks. This is a purely mechanical question. The sludge is a thick black liquid, which may be pumped out of the tanks or lifted out by bucket-pumps into troughs, which serve to convey it wherever it may be wanted.

It will be convenient at this point to consider the amount of sludge produced, its value as a manurial agent, and the methods suggested for its disposal.

[To be continued.]

CINCINNATI WORK IN 1886 AND 1887.



THE architectural year of 1886 has passed out of existence, and, whatever of good or evil that has been done during the year has been left as a "guide unto our feet and a light unto our pathway." Let us but hope that during the coming year even more good and even less evil may be accomplished because of the lessons it has taught.

It is a difficult matter to ascertain, with any degree of accuracy, just how much building has been done in Cincinnati during the year, as the laws now in existence in regard to building permits are somewhat lax; but the records kept are for the present the best we have, and as a basis of comparing one year with another is perhaps a great deal better than nothing; and so we give the number of permits and the total cost of building operations during the past four years, with the advice that it will be safe to multiply by two in each case: —

Year.	Total permits.	Total cost.
1883	773	$2,670,000
1884	774	2,958,000
1885	872	2,145,000
1886	609	2,847,000

It will be seen by comparing the above table that 1886 has held its own, notwithstanding the strikes of last spring, which seemed for a while to tear things wide open and upset the calculations and hopes of builders for a prosperous year. There can be no doubt but that, had the strikes not occurred, there would have been perhaps forty per cent more building, and the strikes, coming as they did in the early spring, when they were not expected, threw building matters into confusion and knocked out two of the best months of the year. However, even those difficulties were overcome, and from present appearances there are no mutterings of any similar strife, and everything now points to a busy season, as things go here.

The journeymen bricklayers have set wages for the coming season at fifty cents per hour, and nine hours to constitute a day's work; this is an advance of five cents per hour over last year, but it will make no practical difference in brickwork, as the prices of brick are lower than last year.

The limestone masons have not yet set the price for their labor, but it will probably be forty-five cents per hour and nine hours to the day. The result will be the same as with the brick masons; that is, labor will be higher but material will be lower, thus making the price per perch about the same as last year.

The freestone cutters and setters have about agreed upon a price for labor which will be satisfactory to all parties concerned, and as no trouble is anticipated in other departments, it may be set down almost as a certainty, that we will be saved a repetition of last season's set-backs.

An important event in connection with the building interests of the city is about to be inaugurated, in the shape of a Permanent Building Exhibit similar to the one in Chicago. The matter has been undertaken by the architects and builders, and promises to be a great help to all persons connected with building houses.

The Cincinnati Chapter of Architects have, during the past three months, been engaged in revising the Building Law that was prepared a year ago, under the sanction of the Builders' Exchange. The Chapter's chief endeavor was to cut the bill down, as it was entirely too large, and in many cases it was inconsistent. The labors of the Chapter have just been completed, and the result is to be submitted to a joint conference of architects and builders, after which it will be ready for the Legislature.

Coming more directly to architecture, the Art Museum on the hill overlooking the city has been completed during the year, at a cost of some $300,000. It is a fire-proof building, in native limestone, with granite trimmings. The designs were published in the *American Architect* for January 9, 1886. Just alongside of the Art Museum,

another building to be used as an art school is now in course of erection under the same architect, J. W. McLaughlin; the walls of this building are now up, the roof-trusses in place. The cost will be about $80,000.

The court-house (also by Mr. McLaughlin) has been finished and lately occupied by the various county officers. It will be remembered that this building was destroyed by fire two years ago this next March, and it seems as though a good piece of work has been done in a short space of time. This is about all of the public work that has been done during the year.

Of the store work, most has been done by Mr. Hannaford, and, while all of them are good, it will not be out of order to state that it does seem as though Mr. Hannaford is getting too much iron into the fronts of his building, and it may not be long until the iron manufacturers will be doing what they did some fifteen years ago; *i. e.*, repeating store fronts from old patterns without the aid of architects. Without exception they all have two stories of ironwork, and the last one (H. and S. Pogue, on Fourth Street) is all of iron, and while it is good, yet there may be nothing to prevent another one from the same patterns being put up anywhere else without the usual commission of five per cent being paid the architect.

Of the stores referred to as having been put up by Mr. Hannaford, there is the row of six on Fourth Street, between Central Ave. and John, for the Goff Estate; one for John Simpkinson, one square farther up on Fourth Street; and one nearly opposite, for Mr. H. W. Derby, which also goes around the corner and has a similar front on Central Avenue. The three stores corner of Fourth and Elm Streets, 100′ x 150′, were completed early in the year; one for Louis Seasongood, on Sixth Street, near John, and others might be mentioned.

The United Bank Building, by H. E. Seiter, corner of Third and Walnut Streets, is of pressed-brick and terra-cotta, and is a pleasing innovation on the style of mercantile building that has been the rage here for years. Of the prospective buildings for the coming spring, another letter had best set out the number and merits. C. C.

BOOKS AND PAPERS.

FORTUNY.[1]

SPAIN has never been famous for the number of its great artists, but when a native of that sunny land is born with the divine fire his genius does not fail to develop like the luxuriant flowers of his own Andalusia, blossoming out with a dazzling brilliancy, which throws all lesser light into shade, rising to the utmost possibilities of art almost at a bound, disdainful of critics and academies, an artist *sui generis*. Such was Murillo, and in our own time such has been Mariano Fortuny.

Any one to whom it has fallen to be beleaguered in a small Spanish town can appreciate the thoroughly inartistic character of Fortuny's early surroundings. He was born at Reus, a few miles from Tarragona, June 11, 1838. His parents were poor, and his education was limited to what he received at the village school, poor enough at the best; but a boon to him for the little drawing mingled with the grammar and arithmetic. He drew by instinct, and his attempts having attracted the attention of a local art patron, the young genius was given a palette and brush, and taught how to use them. When the boy was twelve years old, he lost his father and mother, and fell to the care of his grandfather, by trade a joiner, who added to his small wages by exhibiting a small collection of wax figures, which the old man modelled and the future artist covered with color. When Fortuny was fourteen, the grandfather and the boy went to Barcelona to seek their fortunes. They were still so poor that the whole journey was made on foot. Fortuny's fortune came first in the shape of a native sculptor, who took an interest in the boy, and succeeded in obtaining for him a pension from the city of eight dollars and forty cents a month. Upon this munificent bounty, Fortuny was enabled to follow the courses at the Academia de Bellas Artes in Barcelona, and with such success that at the age of nineteen, he won the Prix de Rome. At Rome his progress was no less rapid than in Barcelona, though his work of that period shows that he had not yet appreciated the true bent of his genius. Two years later it was revealed to him under most striking circumstances. Queen Isabella declared war against Morocco, and in the patriotic anticipations of an easy conquest, Fortuny was summoned from Rome by the city of Barcelona, and commissioned to accompany the local volunteer corps to the land of the Moors, in order to fitly represent their deeds of valor in a huge painting for the town-hall. The expedition departed, and for six months Fortuny was in a painter's paradise, observing every thing, noting the thousand wonderful effects of poetic color, which cling about Arab life and architecture, fascinated by the wild charms of the Moorish civilization, the horses, the curious types, the rich stuffs, the arms, and the strange costumes of the black soldiery. One day the emperor of Morocco came in all the splendor of his sumptuous array, and Fortuny's pencil flew only less rapidly than his imagination. Indeed, the civil life of the Moors, the picturesque episodes, and the dazzling bits of color and detail so won the heart of our painter, that the historic battle-piece was neglected or forgotten, and the only return Barcelona ever received was a huge, empty canvas. Fortuny's genius did not lie in great compositions. Dazzled himself by a new revelation, his mission henceforth was to dazzle others by his art. He struggled manfully with his task, however; took the huge canvas back with him to Rome, painted at it and about it, and did all he could to redeem his pledge to the city which had given him an art education, solacing himself between times with bits of art in his own true vein — brilliant water-colors, Moorish interiors painted as only Fortuny could paint them, besides a few more important paintings wherein his fancy had full freedom to introduce all the rich, transparent tones and wonderfully-executed accessories which are so characteristic of his style. It may be of interest to note a fact not mentioned by his French biographer, that one of the first art amateurs to seek out and appreciate Fortuny's talent was an American, Mr. W. H. Stewart.

By 1866, Fortuny was beginning to have a more than local reputation. His name was spoken in Paris, and Goupil agreed to take a certain number of water-colors at one hundred francs each. In the autumn of the same year he went to Paris, being then twenty-eight years of age, and spent some time studying under Meissonier and Gérôme. Fortuny was by nature an exact draughtsman when he cared to be, but his studies under these masters made him appreciate more fully the small values, and helped him greatly in his technique. The next year he married the daughter of Madrazo, the Spanish court painter, and by his marriage came into possession of quite a snug little fortune, which permitted him thereafter to be entirely independent. He returned to Rome with his wife, and established his studio there, soon creating a reputation for his works, which were beginning to bring high prices in the artistic world: and drawing about him a coterie of artists, all eager imitators of his style, and all enthusiastic admirers of his extraordinary genius. It was about this time that he made the acquaintance of Henri Regnault: the correspondence of the author of the "Salomé," shows how strongly he was impressed by the works of the Spanish painter. "*J'ai passé avant-hier la journée chez Fortuny et cela m'a cassé bras et jambes. Il est étonnant ce gaillard-là! Il a des merveilles chez lui; c'est notre maître à tous.*" But outside of a comparatively restricted circle, Fortuny was then almost unknown. He cared little for mere renown, was of a retiring disposition, had now no need of patronage, and those who would know him were obliged to seek him out. In 1870, he exposed at Goupil's his "Spanish Marriage," which created quite a furore among artists, and prepared the way for his chef-d'œuvre, "The Choice of a Model," which appeared shortly after. This painting, the gem of the Stewart collection, established Fortuny's reputation incontestably, and confirmed the considerable prices that had been put on his works.

From 1870 to 1872, Fortuny lived in Grenada among the bewitching loveliness of the Alhambra. There he was at his best. All the thousand and one diversified beauties of that dream-like Moorish palace found a ready echo in his mind, and a sure interpreter in his pencil and brush. It was in the gardens of the Alhambra that he for the first and almost the only time in his life painted something which was more than a reflection — something which showed thought, as well as talent — the "Rehearsal of a Tragedy in a Garden;" a wonder setting of a luxuriant Moorish garden about a few figures simply and effectively posed; a painting impossible to describe to one who has not seen it; but showing Fortuny at his best in many ways.

In the spring of 1874, he established himself near Naples, and made a quantity of enthusiastic studies. In November he made a visit to Rome, and had an attack of fever, which he succeeded in overcoming; but an after attack took him unawares, and he died the 21st of November, 1874. He was then thirty-six years of age.

The influence of Fortuny has been very widely felt. Endowed with a wonderful natural ability as a draughtsman, without wishing it he created the school of the hand, and established a precedent which has led many a young artist, less richly endowed naturally, into weakly copying his delusive style. Fortuny's real science added to an incontestable charm that every one admits, his love of light and sunshine, a certain unexpectedness in his choice of subjects in his ideas and in his technique, gave him his reputation, and it was a legitimate one. But he astonishes more than he moves. One can not but feel that the greater share of his works have been inspired by the accessories grouped in them, and that like Gilbert and Sullivan's operas, his paintings were first made and then named. For instance, in "The Choice of a Model," the beautiful hall of the Palazzo Colonna at Rome had evidently tempted him, and he had reasoned that the scene which would best suit such an interior would be that embodying a display of elaborate costumes in opposition to the figure entirely nude. For the "Spanish Marriage," he perhaps saw some beautiful sacristy such as exist in Spain and Italy, and said to himself that the signing of the act of marriage in the last century would be a group best calculated to show off such architecture. He executed with a rapidity without equal; but his very mastery of technique — or was it a deeper appreciation of the value of opposition by contrast — led him sometimes to slight one portion of a figure while another would be finished with microscopic exactness; he would even leave the surface of his canvas or paper to give all the effect, and with most surprising results. M. Yriarte tells of one of his most successful water-colors, which was made on a piece of paper

[1] "*Les Artistes Célèbres, — Fortuny:*" par Charles Yriarte, Inspecteur des Beaux-Arts.

that had been half-burned and scorched over with odd spots. Fortuny saw in it a background all ready prepared, and without any thought of performing a feat of artistic gymnastics, accepted it as so much help towards the finished picture. But though he very early in life made up his mind about the kind of work he wanted to do, his genius was by no means fully developed at the time of his death, and he evidently appreciated the fact himself, for as late as October, 1873, he wrote to a friend, "To-day, I have no debts, I have even something put by, and my independence is assured. I am now only beginning to do what I feel, and what pleases me."

Into what Fortuny might have developed had his life been spared, it is impossible to say; but his artistic character as he left it can be well summed up in M. Yriarte's words, "*Véritable charmeur, plein de séductions, qui visait aux yeux et nous éblouissait.*"

JOHNSON'S SURVEYING.[1]

WHILE books on engineering science, as applied to construction, drainage and water-supply, follow one another rapidly from the press, the subject of surveying continues to be taught, in most technical schools, without further aid from text-books than such as can be obtained from works which treat of methods of practice, and of instruments and appliances, which have for years been replaced by better ones, while the scope of most of them is restricted to land-surveying alone. By lectures in the schools, and by practical experience and the reading of the professional journals, the young engineer is able to make good in some degree the deficiencies of text-book literature, but at a serious loss of time, and Professor Johnson has done a service to the science, as well as to those who wish to study it, by collecting in one compact book, clearly and concisely written and well arranged for students' needs, a treatise on the modern art of land-surveying, with all its important extensions and applications, in the form of topographical work, railroad, hydrographic and mining surveying and geodesy, to which are added special chapters on city practice, on topographical drawing, and on earthwork, and some useful appendices on the judicial functions of surveyors, on the instructions to the United States deputy mineral surveyors, with tables of trigonometric formulæ, four-place logarithms, natural sines and tangents and others, and an isogonic chart of the United States, showing the average variation or declination of the compass for the year 1885 at all points. Notwithstanding the comprehensiveness of the book, it is extremely practical. To use the author's own words, the problems of the old text-books on surveying whose only claim for attention is that of geometrical interest have been omitted, to make room for descriptions of improved methods or apparatus. In the latter respect, particularly, much new matter is to be found, and it may be supposed that a work which describes and explains, both theoretically and practically, all the principal forms of suspended and rolling planimeters, the Saegmuller solar attachment to the transit, and the heliotrope as applied to geodetic work, leaves nothing to be desired. In the discussion of methods applicable to particular classes of investigation, Professor Johnson has not trusted to his own experience, but has enlisted the services of specialists to make his book more valuable, calling upon Mr. William Bonton, the City Surveyor of St. Louis, for the chapter on City Surveying, on Mr. C. A. Russell, United States Deputy Mineral Surveyor at Boulder, Colorado, for the chapter on Mining Surveying, and on Justice Cooley, of the Supreme Court of Michigan, for the admirable Appendix on the Judicial Functions of Surveyors.

WE have received from M. Rouam, the well-known Paris publisher, the first two volumes of what appears to be a most excellent book of reference in a "*Dictionaire des Marques et Monogrammes de Graveurs*," by Georges Duplessis and Henri Bouchot. Both of these gentlemen are of the staff of the Bibliothèque Nationale, M. Duplessis being keeper of the prints. The volumes which we have comprise the letters A to O inclusive, are of 16mo size and finely printed on hand-made paper. They include the distinguishing devices of the engravers from the earliest times of the art to the present day, and form part of a series of "*Guides du Collectionneur*" now being issued by M. Rouam.

COMMUNICATIONS

ADVICE TO STUDENTS.

LEWISTON, ME., December 28, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Will you please advise me, through your column of communications, which of the following methods of study would, in your opinion, be of the greatest advantage to one who has already spent three years in an architect's office, and has acquired a fair knowledge of construction and designing of the less complex work:—

1. A six months' trip through England, France and Italy.

2. The same length of time spent in study at the School of Fine Arts, Paris, or

3. The same length of time spent at the Massachusetts School of Technology, studying the theoretical part of architecture, which one does not get in an architect's office. Yours, E.

[UNDER the circumstances it seems to us that the first scheme promises the best results, if the trip is made seriously and not for amusement, particularly if, besides sketch-books, one or two manuals of construction, of history, or whatever else, are packed up for use in evenings and rainy days. In Paris our correspondent should enter some of the evening drawing classes, and should consult libraries, besides doing the usual amount of sight-seeing, and in London he should time his trip so as to be able to attend a course of Architectural Association or Royal Academy lectures. — EDS. AMERICAN ARCHITECT.]

MONMOUTH, ILL., December 3, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—An architect, of whom I inquired what institution he would recommend as the best in which to obtain architectural training, referred me to you, as he was educated in Germany. Would you kindly do me the favor to answer the question. And also, is it customary or desirable to work in an architect's office before going to a school? I graduate from Monmouth College this spring.

Respectfully, D. E. WAID.

[IT depends largely on temperament whether office-work before study is beneficial or prejudicial to the student, and his desire to become a designer or a constructor must also be reckoned with. A student who, after a year or two in an office, seeks instruction in design, often finds himself embarrassed by his knowledge of merchantable sizes and the methods in vogue in the office of his former employer. The result usually is that his designs are thin and meagre, although they can unquestionably be built. On the other hand, the student who becomes a facile designer, according to the academic methods, is often annoyed, when he first undertakes to handle actual building operations, to find that it is far from an easy or obvious thing to build what he has so effectively designed. Still as proper instruction will diminish this evil, we incline to think that the best and natural course for one who proposes to design that which he is to build is to receive his instruction in design before he enters on practical every-day office-work. If the student can spare time to take the full course at Columbia College, New York, we advise him to take that course: if he cannot spare the time, a special course at the Institute of Technology, Boston, is the best thing for him. —EDS. AMERICAN ARCHITECT.]

EATON, OHIO, December 30, 1886.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—The enclosed letter from Mr. G. will explain my application to you, and in accordance with his advice I will state the case to you as short as possible.

I am a carpenter by trade and follow building, and have erected by contract a number of public and private buildings, and am fairly well informed on all that relates to the material or labor required in the erection of any building. I have done a good deal of drafting in connection with my building, and have drawn a number of plans complete which passed with praise, but as I never received any instruction in architecture except such as I learned from different works on drafting and architecture, I know, of course, that I am crude and uninformed on many points, and my wish is to find a school or place of instruction where I can correct these.

I am aware there are many schools where architecture is taught, but all I am informed of require a three to five years' course, and do not meet my wishes.

Any information you can give me on the subject will be thankfully received. Yours truly, WM. MCCABE.

[THE course for our correspondent to follow is to spend a year or two in the architectural department of the Massachusetts Institute of Technology, Boston, where they admit special students, and where it is possible, within reasonable limits, for a student to follow his own bent and devote himself mainly to the study of those branches in which his previous education has left him deficient. With the aid of capable instructors, the freedom of a good library and collections, and the influence of the architectural character of Boston buildings, a builder, such as we take our correspondent to be, should be able to transform himself into an architect more speedily than by any other course we can devise. — EDS. AMERICAN ARCHITECT.]

A PROBLEM IN SLOW-BURNING CONSTRUCTION.

TORONTO, January 7, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—How would you adapt the system of slow-burning construction to a college building under the following conditions:

1. Rooms to be of sizes ranging from 19′ x 30′ to 36′ x 39′.

2. No columns to be used and, as far as possible, ceilings to be unobstructed by beams.

If these conditions are impracticable, what would be the least amount of obstruction by columns and otherwise required.

ENQUIRER

[USE beams heavy enough to carry safely the floor and the required load, spacing the beams not less than five feet apart, and more, if possible, up to nine or ten feet. Cover with three or four inch splined planks, according to the distance between the beams, with seven-eighths inch or one and one-fourth inch flooring over, and plaster the ceiling below on wire lath, carrying the wire around the beams and close to the underside of planks, leaving only space enough between the wire and the wood for the clinch of the mortar. Just where the beams should be placed, and what should be their size and spacing, it would be impossible to say without knowing all the details of the plan, the position of doors and windows, and so on. To cover rooms of the size mentioned on the slow-burning principle without

[1] "*The Theory and Practice of Surveying*." Designed for the Use of Surveyors and Engineers Generally, but especially for the Use of Students in Engineering. By J. B. Johnson, C. E. Professor of Civil Engineering in Washington University, St. Louis, Mo. New York: John Wiley & Sons, 15 Astor Place, 1886.

showing the beams in the room would be impracticable unless by furring in some way so as to get a level ceiling on wire lath below the level of underside of main timbers, and this detracts somewhat from the fire-resisting quality of the construction. With nothing more than the actual weights usual in such structures to provide for, we see no reason why the floors could not be carried without columns, though the large rooms would require very heavy timbers. It should be observed that sound passes much more readily through floors of this kind than through those of the ordinary construction, and if this should be an objection it might be well to adopt some less efficient, but still tolerably reliable precaution against fire, such, for instance, as laying the floors with beams of the ordinary kind, and spaced as usual, but plastering underneath on wire instead of laths, and, in addition, deafening with mortar on top of the under flooring. With brick partition-walls, through which fire could not ascend, this would be a good and not very expensive construction. — Eds. American Architect.]

NOTES & CLIPPINGS

Artesian-wells for London.— The City Commissioners of Sewers, at their meeting yesterday forwarded by one step a controversy which has been long pending. They carried a motion requesting the Finance and Improvement Committee to "report forthwith" on the power of the commission to sink artesian wells in the city, with a view to being independent of the water companies. In the course of a rather desultory discussion one speaker broadly hinted that the desired independence might be an expensive luxury. When there was a question of supplying a block of artisans' dwellings with water it was found that the cost of sinking the well would be £2,000, and that its maintenance would amount to £180 a year more, as against £60 a year, which was the water-rate for the buildings. This, however, does not dispose of the whole question. Supposing the artesian-well to tap a stratum of pure water, the supply would, beyond question, amply suffice for more than one block of buildings, and that, too, on a far more liberal scale than that of the measured and grudging doles afforded by the companies. That there is a plentiful store of water under London far beyond the reach of sewage contamination is almost certain, and it is a pity that it should not be in some way utilized by a city which needs so much more cleaning than it gets. It is possible that in boring for ordinary water the commission might come upon a chalybeate or saline spring which would supply London with a home-produced Apollinaris or Hunyadi water. The Beulah Spa on one side, and Bagnigge and other "wells" on the other, are not far off, while only six years ago, from a deep well sunk in Bunhill Fields, was drawn a liquid said to resemble the famous Carlsbad water — so very wholesome and so excessively nasty. Probably, however, the commission would be well content with such water as could, within the memory of men now living, be had from at least a dozen well-known pumps within half a mile of St. Paul's. Those particular sources have long ago been rightly condemned, but it is a paradox to maintain that water brought to us after painful filtrations and long journeys through miles of piping, can be both cheaper and better than that which is filtered naturally through the lower strata, and is ready, when tapped, to rise to the surface at our own doors.— *London Standard.*

The Channel Tunnel.— The shareholders of the Submarine Continental Railway Company held their ordinary general meeting on the 16th inst., at the office of the southeastern terminus, London Bridge. Sir Edward Watkin, Bart. M.P., presided, and, in moving the adoption of the report, said that the Board had carried out the proposals of the shareholders under which they agreed to absorb the property, effects, rights and privileges of the Channel Tunnel Company on the terms which the proprietors had approved. He could not help saying that the progress of the Channel Company was a record of engineering mistakes. First of all it was proposed to construct the tunnel between Calais and St. Margaret's, but that having proved to be an egregious engineering mistake, they shifted their ground on this side to a place called Fair Hole. The directors, however, instructed their engineer to make a boring at the place where it was proposed to bring the tunnel on this side of the Channel, and they found that they were draining the land springs on the Dover side of the Channel. They had, therefore, come back to this position. They had proved beyond the shadow of a doubt that the only way to make a tunnel between the coast of France and the coast of England was by finding the grey chalk, as they had done, and following it to the other side of the Channel. He was happy to tell them that the stratum through which they were going was grey chalk, and their tunnel of 2,200 odd yards was practically dry. There was another fact of equal importance, and that was that the chalk walls and roofs of the tunnel showed no signs of decay. On the contrary, the surface of the grey chalk grew harder as time went on. When it was an unproved condition of things that the tunnel could be bored between France and England a large number of persons were for it, but the moment they proved that it could be done easily and cheaply some persons began to see great international dangers. They received a letter yesterday from the Board of Trade asking to inspect the tunnel. The Board stated that they thought it essential that Lord Stanley of Preston should go and see the Channel works himself. They believed that because Mr. Chamberlain, the late president of the Board of Trade, did not see the tunnel with his own eyes, he had arrested its progress. After quoting from a letter of Lord Derby addressed to Lord Beaconsfield, in which the former stated that the Government ought to support the tunnel, Sir Edward concluded by stating that the time would come when prejudice would blow away like the fogs of morning, and when those who had promoted civilization and peace would get their own reward, not only in the pecuniary way, but in the belief that in constructing the tunnel they had done their duty. Mr. G. Cavendish Bentinck, M.P., seconded the motion, which was carried. The meeting was subsequently declared special, when a resolution was agreed to approving the bill empowering the company to continue experimental works for a tunnel beneath the Straits of Dover, and for other purposes.— *The Architect.*

TRADE SURVEYS

The general course of prices is still upwards. In several industries this upward tendency has received a slight check by the extraordinary advance in quotations for crude material and finished products which have been perhaps unwisely made. The intelligent and conservative public opinion of the country is decidedly against any sudden advance or fluctuations in material. A sort of commercial and industrial instinct has been growing throughout the country, for a year or two past, against these changes, and the country at large has been endeavoring to so regulate its production and distribution as to avoid the hazardous changes which, in its past, have upset all business calculations. Every industry shows some evidence of the unsettling influences at work, some a great deal more than others. Investors who contemplate extensive operations of one kind or another during the coming season have been somewhat alarmed at the fluctuations of the past thirty days. Just as soon as they were satisfied that the labor question was likely to be passed over without serious agitations another factor arose, namely, the possibility of an unwise advance in prices. Thus far the building trades have not been affected. It is useless at this time to pretend to anticipate the effect of causes at work. Just now the indications point to a further advance of prices all around. The fact that from three to six months' supplies have been contracted for at low prices will act as a cushion to the damaging results that the recent advance may involve. Prices are very firm in all markets. Iron and steel are taking the lead. An advance of from three to five dollars per ton has been made within a month in steel rails, but fortunately rails enough to lay as much as 12,000 miles of road have already been contracted for at $34 to $35. The advance from $37 to $40 does not, therefore, mean very serious results to the railroad builders. Those who will suffer are those who are able to suffer, namely, the well-fixed railroad companies, including the trunk lines and the host of well-established railroad companies over the West and South. These buyers will, no doubt, be obliged to pay at least three to four dollars per ton more for what rails they will want. The unsold capacity has been estimated by some authorities at 600,000 tons, and if this product sells at the advance of $4 per ton over last autumn's price it will make a difference to the companies of some $2,500,000. This advance, if it does retard railroad-building enterprise, will be beneficial rather than otherwise, as there is a tendency to rush too rapidly into railroad construction. The published records of railroad bankruptcy show that considerable mileage is still unprofitable, but the present investors and projectors of roads are basing their calculations not upon the past and its unprofitable realizations, but upon the future and its promising increase of traffic and dividends. There is certainly much encouragement to be met with, enough at least to attract millions of idle capital into new railway enterprises all over the country. The iron and steel industries are in a phenomenally prosperous condition. Pig-iron production has now reached about 128,000 tons per week, and furnaces are being built and projected. The pipe-makers have hundreds of miles of pipe under contract. The brokers for old material are unable to meet half of the demands presented. Brokers representing foreign steel and iron makers have been checked in their negotiations for their American customers by the sudden advance of prices in foreign markets. Cablegrams show a general improvement in iron and steel throughout Great Britain and Europe. The host of new enterprises are the result of the great activity of the past two or three months on our side, and the projection of these enterprises is the basis of the advance now being attempted. It is possible that these enterprises may be alarmed and checked, but the chances are that they will plunge ahead and accept all the risks involved. The coal-mining industry also shows as favorable results as others. The makers of machinery have all begun to book orders for heavy machinery for spring and summer delivery to manufacturers of all kinds and in all parts of the country. Whatever the wisdom of it may be the fact is that we will witness this year a very heavy increase in our machinery capacity. The increase will not be confined to four or five lines, but to all lines of manufacturing. Boston shows a fair increase in building activity in 1886 over 1885; New York has expended some $13,000,000, if the estimates are correct; Philadelphia has exceeded its 1885 record by some $7,000,000 if guess-work will answer and Chicago's figures show an increase from $19,000,000 to $27,000,000. The figures of St. Louis show a great increase as also do St. Paul, Minneapolis, Kansas City, and several of the larger cities in the South. The best posted architects throughout the West incline to rather bullish views in regard to building construction as well as to railroad construction. In fact, they base their predictions, or rather their opinions, as to the building activity of 1887 on the railroad construction which they know will take place. It is simply a logical calculation over admitted premises. So far as can be ascertained there is no reason for expecting any less increase in 1887 over the increase of 1886 than 1886 has shown over 1885. The boom, if it is one, will expand until it explodes, but for reasons frequently heretofore enumerated it is fair to say that the activity now enjoyed is not a boom, but is a legitimate growth from causes which have been silently working for many years. The low rate of interest on money, the strengthening confidence in new enterprises, the growing interests of the people, the increasing profitableness of agricultural operations, mining and lumbering operations all go to strengthen the demand for all kinds of staple products, and this improving demand is the best for the building activity which is not yet showing any signs of exhaustion. In whatever industry the endeavor to probe for indications of weakness is made, we find nothing to warrant unfavorable conclusions. It is very true that manufacturers and jobbers and retailers, and all who make and handle products of any kind, are complaining of low prices, lower than they ought to be. But, on the other hand, the margins, as compared with those of a year ago, certainly show that an improvement has taken place. The year opens with bright prospects for real estate not only in all our large cities, but in all of the smaller cities and towns from which reports have been received. The most favorable feature is that the improvement made is legitimate and not speculative, and it is evident that holders of real estate are more anxious to see property improve than to hold property in check for farther advance excepting where, as is frequently the case, valuable sites are held back by testamentary conditions. The improvements in real estate may possibly take a sudden start, but it so happens that the building interests in most of our cities have taken time by the forelock and have purchased much property for future operations. This is a notable truth in New York, Philadelphia, Chicago and St. Louis. In addition to this activity a great deal of suburban property and of farming lands have been purchased near large cities. This is due partially to the fact that suburban properties are to be had at low prices, and partly to the fact that investments are desirable and farming lands near larger cities are selected as the most desirable form of investments out of stocks and bonds by a large number of producers.